

In the United States Court of Federal Claims

OFFICE OF SPECIAL MASTERS

No. 19-1600V

Filed: April 23, 2025

* * * * *
KRISTINE BALLARD,

Petitioner,

v.

SECRETARY OF HEALTH
AND HUMAN SERVICES,

Respondent.
* * * * *

David J. Carney, Esq., Green & Schafle LLC, Philadelphia, PA, for petitioner.
Parisa Tabassian, Esq., U.S. Department of Justice, Washington, DC, for respondent.

RULING ON ENTITLEMENT¹

Roth, Special Master:

On October 15, 2019, Kristine Ballard (“petitioner”) filed a petition for compensation pursuant to the National Vaccine Injury Compensation Program.² ECF No. 1. Petitioner alleges that she developed dermatomyositis (“DM”) as a result of the influenza (“flu”) vaccine she received on November 3, 2018. *See* Petition (“Pet.”), ECF No. 1.

Following review of all the evidence presented, I find that petitioner has provided preponderant evidence that the flu vaccine she received on November 3, 2018 triggered her development of dermatomyositis.

¹ Because this Ruling contains a reasoned explanation for the action taken in this case, it must be made publicly accessible and will be posted on the United States Court of Federal Claims’ website, and/or at <https://www.govinfo.gov/app/collection/uscourts/national/cofc>, in accordance with the E-Government Act of 2002. 44 U.S.C. § 3501 note (2018) (Federal Management and Promotion of Electronic Government Services). This means the Ruling will be available to anyone with access to the internet. In accordance with Vaccine Rule 18(b), the parties have 14 days to identify and move to redact medical or other information, the disclosure of which would constitute an unwarranted invasion of privacy. Any changes will appear in the document posted on the website.

² National Childhood Vaccine Injury Act of 1986, Pub. L. No. 99-660, 100 Stat. 3755. Hereinafter, for ease of citation, all “§” references to the Vaccine Act will be to the pertinent subparagraph of 42 U.S.C. § 300aa (2018).

I. Procedural History

The petition was filed on October 15, 2019. ECF No. 1. Between October 28, 2019 and November 11, 2020, petitioner filed her medical records and two affidavits. Petitioner's Exhibits ("Pet. Ex.") 1-17, ECF Nos. 6, 14, 19, 23, 26.

Respondent filed his Rule 4(c) Report on November 23, 2020, stating his position that this case was not appropriate for compensation. ECF No. 27.

Petitioner filed her expert reports from Dr. Eric Gershwin along with supporting medical literature³ on March 22, 2021 and August 19, 2021. Pet. Ex. 18; Pet. Ex. 23. Respondent filed expert reports from Dr. Emmanuel Maverakis along with supporting medical literature on July 6, 2021 and October 18, 2021. Respondent's Exhibit ("Resp. Ex.") A; Resp. Ex. C.

A Rule 5 conference was held on December 1, 2021. Updated medical records were filed thereafter from February 28, 2022 through April 22, 2022. Pet. Ex. 24-29, ECF Nos. 42-43, 45, 47.

On May 17, 2022, petitioner filed a status report advising that she preferred to proceed by filing a Motion for Ruling on the Record in order to resolve entitlement. ECF No. 50. A briefing schedule was set, and petitioner filed her Motion on June 30, 2022. Motion, ECF No. 51. Respondent filed his Response on July 14, 2022. Response, ECF No. 52. Petitioner filed a Reply on July 25, 2022. Reply, ECF No. 54.

This matter is ripe for ruling on the record.

II. Medical Terminology

Dermatomyositis ("DM") is an autoimmune disease. Pet. Ex. 20(a) at 1.⁴ Diagnosis requires the presence of the "characteristic rash" with at least three of the following muscle symptoms: symmetrical proximal weakness, elevated muscle enzymes, EMG changes consistent with irritable myopathy, or necrosis and inflammation on muscle biopsy. Pet. Ex. 20(v) at 1.⁵ The characteristic rash includes photosensitive erythema,⁶ Gottron papules,⁷ and a periorbital heliotrope rash,⁸ with both the heliotrope rash and Gottron papules pathognomonic for DM. Adults may also develop thickened, erythematous, and scaly rashes on the fingertips and sides of

³ Petitioner's medical literature was filed incorrectly and failed to comply with the Vaccine Guidelines for filing each article as a separate exhibit number.

⁴ Thorsten Hornung & Joerg Wenzel, *Innate Immune-Response Mechanisms in Dermatomyositis: An Update on Pathogenesis, Diagnosis and Treatment*, 74 DRUGS 981 (2014), filed as "Pet. Ex. 20(a)".

⁵ Angela B. Robinson & Ann M. Reed, *Clinical Features, Pathogenesis and Treatment of Juvenile and Adult Dermatomyositis*, 7 NATURE REV. RHEUMATOLOGY 664 (2011), filed as "Pet. Ex. 20(v)".

⁶ Erythema is redness of the skin produced by congestion of the capillaries. Erythema, DORLAND'S ILLUSTRATED MEDICAL DICTIONARY 636 (33rd ed. 2020) [hereinafter DORLAND'S].

⁷ Gottron papules consist of discolored lichenoid flat-topped papules over the knuckles. Gottron papules, DORLAND'S 491, 1353.

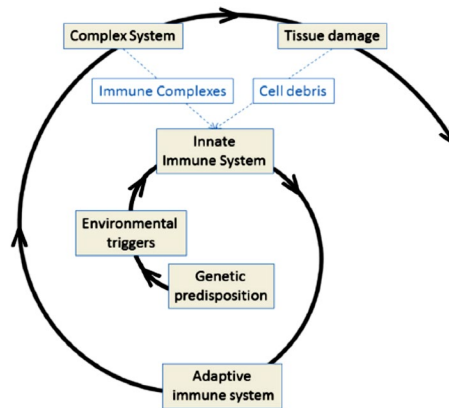
⁸ Heliotrope rash is a pink to purple rash seen most often around the eyes of persons with dermatomyositis. Heliotrope rash, DORLAND'S 1568.

fingers. Evidence of small-vessel inflammation can be seen in the nail folds, eyelids, and gums. *Id.*

Inflammatory myopathies like DM are more common in females with the average age of onset between 40 and 60 years of age. Pet. Ex. 20(v) at 1.⁹ While there is an overlap in symptoms of DM in adults and in children, children (whose condition is referred to as juvenile dermatomyositis) have a better long-term prognosis while adults have an increased risk of malignancy and are more likely to develop interstitial lung disease. *Id.* at 2. Adult DM is treated with corticosteroids and multiple immunosuppressive agents. *Id.* at 8.

DM is believed to involve both genetic predisposition and environmental triggers, such as ultraviolet light, certain medications, medical devices, vaccines, and certain infections. Pet. Ex. 20(v) at 5, 7;¹⁰ Resp. Ex. A Tab 6 at 1.¹¹ The environmental factors thought to induce the disease are also thought to trigger flares of DM. Resp. Ex. A Tab 6.

The literature explains that DM is the result of hyperactivation of the innate immune system and dysregulation of the adaptive immune system. Pet. Ex. 20(a) at 1.¹² Recent studies have demonstrated that high expression of interferons (“IFNs”) and IFN-regulated proteins are a key feature of the activation of the innate immune system in DM, thereby supporting a “potential functional pathogenic role” of IFN in DM. *Id.* at 1, 4. Simply, environmental triggers activate the innate immune system then the adaptive immune system with the adaptive response reactivating the innate response, creating a “vicious circle” of sustained inflammation. This process is illustrated below:



Pet. Ex. 20(a) at 5, Figure 1.

⁹ Robinson & Reed, *supra* note 5.

¹⁰ *Id.*

¹¹ Gulnara Mamyrova et al., *Environmental Factors Associated with Disease Flare in Juvenile and Adult Dermatomyositis*, 56 RHEUMATOLOGY 1342 (2017), filed as “Resp. Ex. A Tab 6”.

¹² Hornung & Wenzel, *supra* note 4.

III. Background

A. Petitioner's History Prior to the Subject Vaccination

In February of 2014, petitioner established care with her primary care physician ("PCP") providing a history of asthma, kidney stones, stomach ulcers, and allergic rhinitis. Pet. Ex. 3 at 55.

In the year prior to receipt of the subject flu vaccination, she presented for complaints associated with asthma, "debilitating IBS" ongoing for three years, and allergies. She complained of restless leg syndrome. Pet. Ex. 3 at 16-17, 23-24. She also presented to an ENT for allergy symptoms. *Id.* at 77. She had the flu in March of 2018. *Id.* at 18. Petitioner also received cosmetic treatments throughout 2018. Pet. Ex. 4 at 29-38; Pet. Ex. 11 at 4. Petitioner presented to Stockton Dermatology ("Stockton") in July of 2018 for diagnosis and removal of 3mm growing pink papule on the right side of her nose. Pet. Ex. 4 at 39-47.

Petitioner received the subject flu vaccine at Safeway Pharmacy on November 3, 2018. Pet. Ex. 1 at 3-4.

B. Petitioner's History Following the Subject Vaccination

On November 18, 2018, petitioner presented to Senti Bella Medical Salon ("Senti") for a cosmetic procedure at which time the nurse documented that petitioner had a "rash on arm, thinks it may be eczema? Suggested she see dermatologist". Pet. Ex. 11 at 4.

Two months later, on January 15, 2019, petitioner presented to her PCP and reported a painful and itchy rash for over a month that spread from her leg to her chest, arms, and ears. She also reported swollen cuticles and sensitivity to sound. She was using a topical cream for eczema that did not help. Examination revealed "erythemic maculopapular rashes" of her shins, chest, ears, and arms. Pet. Ex. 3 at 13. She had no joint pain, joint swelling, or back pain. *Id.* at 14. She was encouraged to take pictures of the rash then start prednisone and hydroxyzine and follow up with the dermatologist. *Id.*

Petitioner presented to Stockton on January 24, 2019 with a new history of skin eruptions over her entire body for 3 weeks that were spreading, painful, stinging, burning, and felt hot. She had been using coconut oil or vitamin E several times a week before this started but stopped when the rash started. Her PCP prescribed prednisone for 5 days which did not help. Pet. Ex. 4 at 22. She reported that it "[s]tarted as right leg rash 3 weeks ago; then started having ear pain (approx late dec)". Her only recent travel was to Mexico in July 2018. She had no new pets or medications, but her dog had an infection. She had not used any new products. *Id.* Examination of her skin showed several skin eruptions, plaques, Gottron's papules on hands, and cuticle inflammation, all concerning for dermatomyositis vs. lupus vs. contact dermatitis. *Id.* at 23-26. A punch biopsy was performed, and photos were taken of the rash. *Id.* at 27. The plan was for her to use Vanicare products and a prednisone taper for 21 days. Sun protection was discussed. Blood work was ordered. *Id.*

Petitioner returned to Stockton on January 31, 2019 for follow up. She reported that the rash had stopped spreading and was no longer itchy or tender but was still red and dry. She reported that the oral medication was helping, and her skin eruptions were improved upon examination. Pet. Ex. 4 at 16-19. Her blood test and biopsy results were normal with no sign of autoimmune disease. *Id.* at 20, 64, 66-67. The diagnosis included viral “exanthum” and drug eruption. *Id.* at 20. Petitioner had discontinued all over the counter supplements. She was to continue prednisone with follow up in 5-7 days after completion. The rash was compared to prior photos, noting a moderate response to treatment. Sun protection was again discussed. *Id.*

Petitioner returned to Stockton on February 28, 2019 and reported that the rash was spreading and was itchy and red. Her symptoms worsened with dryness, scratching, temperature changes, and sunlight. She had completed the course of prednisone but had a “full explosion recurrence” within two days. She expressed concern for Lyme disease. She also complained of sound sensitivity and occasional vertigo. Pet. Ex. 4 at 10. Review of systems included joint aches and pain. *Id.* at 11. The record stated, “[c]linically very concerning for dermatomyositis; +holster sign, + periungal erythema, +shawl sign, and gottron’s papules”. *Id.* at 14. Additional punch biopsies were performed. *Id.* at 13. The biopsy results were discussed at a March 7, 2019 visit as most likely dermatomyositis. *Id.* at 5-8.

A phone call was documented on April 5, 2019 with Stockton regarding a positive Valley Fever test, which was determined to actually be inconclusive as it was incomplete. Pet. Ex. 4 at 3, 58-59. Lyme disease testing was negative, and a hepatitis panel was nonreactive. *Id.* at 59.

Petitioner presented to the Arizona Arthritis Clinic on May 7, 2019 for rash, muscle pain, and fatigue. Pet. Ex. 8 at 3. The history of present illness included “possible dermatomyositis” that started around the end of December 2018. *Id.* at 4. Petitioner reported that the rash began on her leg then it spread all over her body. She reported some insignificant muscle weakness but some dysphagia¹³ and it felt like she was being choked. She was taking 20mg of prednisone down from 60mg, which stopped the rash from spreading but did not resolve it. She had some weight gain with the prednisone. She further reported that her lupus markers were negative. *Id.* The diagnosis was dermatomyositis, and she was prescribed hydroxychloroquine. *Id.* at 5.

Petitioner presented to Dr. Mallace, a rheumatologist, on June 5, 2019, with “[p]resumptive dermatomyositis” that was responsive to corticosteroids. Pet. Ex. 6 at 6. She reported onset of a pruritic rash in November after a flu vaccine. She had weakness as well. Several biopsies led to a “most likely” diagnosis of dermatomyositis. She had recently seen another rheumatologist who gave the same diagnosis and initiated antimalarial treatment. She had been on high doses of prednisone with partial benefit, but the rash would worsen on weaning. She reported a lot of discomfort and missed time from work. She had a 20-pound weight gain from the steroids. She had itching, occasional dysphagia, questionable dysphonia, and fatigue. She described some weakness and tingling in her left distal lower extremity. *Id.* Examination revealed diffuse macular rash on her trunk and extremities, and some periungal (nail bed) erythema but otherwise normal nail beds. *Id.* at 7. She had mild proximal and distal weakness but normal gait and no weakness in the lower extremities. Range of motion of the extremities was normal without swelling or tenderness. She had a negative ANA on two

¹³ Dysphagia refers to difficulty swallowing. Dysphagia, DORLAND’S 573.

occasions and normal CMP, CK, Aldolase, and anti-Jo-1.¹⁴ *Id.*; Pet. Ex. 8 at 7-8. Additional urine and blood tests for immunological testing were performed. Pet. Ex. 24 at 168-73. Plaquenil was discontinued, and she was prescribed 20mg of prednisone. Pet. Ex. 6 at 7.

On June 16, 2019 petitioner presented to the ER at the Mayo Clinic Hospital for bilateral numbness in her legs and hands for one week. Pet. Ex. 7 at 10. She had been diagnosed with dermatomyositis in March of 2019 with symptoms since last November. *Id.* at 11. She had been prescribed varying increased doses of prednisone during flares. She tried Plaquenil but did not tolerate it well so it was discontinued a week ago. She had the present symptoms for a week but increasing over the past few days. She was followed by rheumatology. Examination revealed no obvious range of motion deficits in the upper or lower extremities, and no hand edema or erythema. There were diffuse erythematous papules on her upper chest. She had scattered lighter colored papules on her upper and lower extremities. *Id.* She appeared to be having a flare of dermatomyositis. *Id.* at 12. Symptoms were not consistent with an acute central neurological process. Labs performed were normal. *Id.* at 12-13, 15-18. The final diagnosis was paresthesia, dermatomyositis, and myalgia. *Id.* at 14.

Petitioner returned to Dr. Mallace on June 26, 2019. She was corticosteroid dependent. It was noted that her symptoms started last November after flu vaccine with “widespread pain and rash more than weakness.” She has taken high dose steroids on and off since last fall with a brief trial of hydroxychloroquine with minimal benefit. Prednisone could not be lowered without breakthrough symptoms. She had a rash and pain, as well as depression from weight gain. Pet. Ex. 6 at 11. She had a macular rash on her forehead, ears, arms, and trunk. There was no weakness, no abnormal reflexes, and no edema. She had normal distal pulses. Prior blood work was normal. EMG of the right upper extremity was normal. *Id.* Blood work performed on that date showed no antibodies for dermatomyositis, but Dr. Mallace noted that negative antibodies did not exclude the diagnosis. Pet. Ex. 24 at 174-80; Pet. Ex. 6 at 12-14. A muscle biopsy would be considered. Pet. Ex. 6 at 12-13.

At an October 31, 2019 visit with Dr. Mallace, petitioner was noted to be taking Azathioprine for a few months along with prednisone which could not be lowered below 15 mg without breakthrough symptoms. She complained of weight gain and fluid retention. She was positive for rash and fluid retention. Pet. Ex. 16 at 6. The assessment was dermatomyositis, taking high risk medications (Azathioprine and prednisone), and slow improvement but still symptomatic. Additional blood work was planned, she was to continue taking Azathioprine, consider Methotrexate, and reduce prednisone with a follow up pending lab results. *Id.*

At a December 30, 2019 dermatology visit, dermatomyositis was noted on petitioner’s face, arms, and chest first noticed in November of 2018. Her medications included a downward titration of prednisone and Imuran (Azathioprine). She complained of rash, photosensitivity, and muscle weakness especially when lifting her arms above her head and when rising from a chair. Pet. Ex. 14 at 3. The impression was DM with “[v]iolaceous erythema in shawl like distribution, proximal muscle weakness, and periungual erythema distributed on the upper sternum, left anterior proximal upper arm, right anterior proximal upper arm, left ring finger proximal interphalangeal joint, left central forehead, right lateral forehead, left lateral malar cheek, and

¹⁴ Anti-Jo-1 is an autoantibody that is associated with DM. See Pet. Ex. 20(v).

right central malar cheek”, which was inadequately controlled. Further evaluations were encouraged. *Id.* Blood work and urine testing was performed on January 3, 2020. *Id.* at 13-15. CT scans of the chest, abdomen, and pelvis with contrast were performed on that date as well and revealed no acute process or lymphadenopathy. *Id.* at 24-25.

Petitioner returned to Dr. Mallace on January 17, 2020 with active rashes that would come and go and muscle weakness. She reported pain and spasm around her tail bone. She had a lot of muscle fatigue in her legs and arms with numbness and tingling in her fingers. “She has calcinosis cutis in the fingers.” She reported five falls in the last three months with some serious falls in December. Pet. Ex. 16 at 7. Dermatology suggested Methotrexate, Plaquenil, and IVIG. She was taking Azathioprine and 9mg of prednisone which she could not taper further. On examination, she had fatigue, gait problems, myalgias, and rash with “[m]uscle weakness in the upper and lower extremities” more pronounced in the lower. *Id.* at 7-8. She was not stable on Azathioprine so it was stopped. *Id.* at 9. She was to switch to Methotrexate and follow up with neurology regarding the weakness. IVIG was noted to be a possibility if Methotrexate did not work. *Id.*

Petitioner presented to a new PCP to establish care on January 24, 2020. She reported a flare of DM for the last 14 months and associated depression. Pet. Ex. 25 at 65-71. She had a shawl distribution rash upon examination. *Id.* at 68. Blood work was performed on that day. *Id.* at 118-20. She returned on January 30, 2020 reporting symptoms consistent with adjustment disorder. *Id.* at 61. Abdominal ultrasound performed on January 31, 2020 was negative/normal. *Id.* at 79.

On February 3, 2020, petitioner presented to neurology. Pet. Ex. 15 at 7. She reported onset of rash and joint/finger pain in November of 2018. She was diagnosed by dermatology with dermatomyositis in February of 2019. She had been treated with high dose steroids. Plaquenil and Imuran had no benefit. She had been taking Methotrexate and folic acid for three weeks. She had daily muscle pain with walking and severe muscle fatigue. She had a rash on her neck, chest, and fingers. *Id.* On examination, she had 5/5 strength and normal muscle mass and tone in all extremities. *Id.* at 9. Sensory was intact, and gait and coordination were normal. The assessment was dermatomyositis without much evidence of active muscle disease given a normal CPK in October. Examination included “some give-way weakness secondary to pain”. The plan was to check CPK again and conduct EMG studies. IVIG was noted to be a reasonable next step. *Id.* at 9-10.

Petitioner followed up with the PCP for illness-related depression on February 12, 2020. Pet. Ex. 25 at 57.

She received infusions for dermatomyositis beginning in early 2020 through 2022. *See generally* Pet. Ex. 28; Pet. Ex. 29.

Petitioner contacted her PCP on February 14, 2020 for disability paperwork. She had elevated liver enzymes due to Methotrexate. She was seeing a counselor for significant illness-related depression. Pet. Ex. 25 at 52, 74.

Petitioner presented to her PCP on February 24, 2020 asking for a letter for work regarding limiting her sun exposure and reporting that she had been ill for two weeks. Pet. Ex. 25 at 47. She was diagnosed with bronchitis and prescribed a Zpack, cefdinir, and prednisone. *Id.* at 49. A chest x-ray on March 12, 2020 was negative. *Id.* at 81.

Petitioner continued to see her PCP for depression and was doing better with medication. She reported doing well for a few weeks without muscle aches and diminished flares after stopping Methotrexate due to elevated liver enzymes but was now “back to normal”. Pet. Ex. 25 at 38.

Petitioner presented to Dr. Mallace on March 18, 2020. She had not taken Methotrexate for three weeks due to elevated liver enzymes and was now getting weakness again in her arms, and legs and severe pain in her left hamstring. Her arms felt “very heavy.” She had trouble breathing and felt short of breath. She had skin lesions on her chest, neck, and upper arms and was taking 8 mg of prednisone daily. Pet. Ex. 16 at 10. Her deductible for IVIG was too expensive so it was not an option. *Id.* at 11. She was to restart Imuran and add Plaquenil in 2-3 weeks. *Id.*

She returned to the PCP on April 9, 2020 for depression and anxiety from flares and pain associated with her dermatomyositis. Her neurologist was trying to get insurance approval for IVIG treatment. Pet. Ex. 25 at 34. She was to continue with her medication. *Id.* at 37.

Petitioner presented to the PCP for medication review on May 14, 2020. She had dry patches of skin with burning that began two weeks ago. Steroid cream, Vaseline, lotion, and vitamin E were not working. Pet. Ex. 25 at 24. She had diffuse maculopapular rash on both arms with erythematous pink plaque upon examination. *Id.* at 26. The assessment was tinea corporis and dermatomyositis. She was instructed to use topical Lamisil and follow up with dermatology. *Id.*

Petitioner presented to her PCP on June 19, 2020 with arm swelling following an IV three days ago. She also needed a letter for work due to being immunocompromised and her sister being exposed to COVID-19. She complained of several months of heartburn. She was doing “very well” with IVIG, and her rash and muscle involvement had significantly improved. She received a vitamin B12 shot. Pet. Ex. 25 at 18. The assessment included improving dermatomyositis, mixed hyperlipidemia, fatigue, IV infiltration, and heartburn. *Id.* at 21. Antibody testing to COVID-19 was ordered. *Id.*

On July 24, 2020, petitioner requested a letter for work to stay home during COVID-19, and stated she would not likely receive a vaccination “as it is believed that her disease was in part caused by vaccination.”¹⁵ Pet. Ex. 25 at 13, 15.

Petitioner had a video visit with the neurologist on July 28, 2020. She was receiving IVIG two days per month for three months. She reported almost complete healing of her skin

¹⁵ The record does not specify *who* believed petitioner’s DM was in part caused by vaccination. See Pet. Ex. 25 at 15.

with muscle improvement. She was no longer taking Plaquenil and was taking Imuran and a low dose of prednisone. Pet. Ex. 25 at 72. She was to stop the prednisone but continue Imuran and IVIG and return in 4 months to see if IVIG could be tapered. *Id.* at 73.

Petitioner presented for a physical on July 30, 2020. Pet. Ex. 25 at 6. She had dermatomyositis but the examination was otherwise normal. *Id.* at 9-10.

Petitioner had a video visit with Dr. Mallace on August 6, 2020. She reported receiving IVIG through neurology and stopping prednisone last week. She was taking Imuran and doing well. She hoped to taper off IVIG within a year. She denied weakness or rashes. Her skin was dry but clearer than before. She still had random muscle pains. Pet. Ex. 16 at 13. Blood work was ordered and performed on August 20, 2020. Pet. Ex. 24 at 153-54.

Petitioner had another video visit with Dr. Mallace on November 6, 2020. She was receiving IVIG treatment every 4 weeks and taking Imuran. The rashes had resolved for the most part, but she still had redness of her face and muscle fatigue when she worked out. She felt this would happen closer in time to her next IVIG infusion. Pet. Ex. 24 at 160.

On March 11, 2021, petitioner reported to neurology in a video visit that she was on IVIG every two weeks with good progress. Pet. Ex. 27 at 20-21.

Petitioner reported a relapse to neurology on August 12, 2021 due to insurance denying her IVIG. Pet. Ex. 27 at 22. She had not had treatment for months and had muscle aches, muscle weakness, and rashes. Efforts to reinstate treatment were undertaken. *Id.* at 22-23.

At a December 7, 2021 visit with neurology, petitioner reported having IVIG treatment twice per week and taking 5mg of prednisone. She had stopped taking Imuran. She reported that she thought she needed the infusions three days a week and was taking ibuprofen for pain. She had not had any rashes lately. She reported five falls in the past six months, with one bad fall where she injured her arm. Pet. Ex. 27 at 24.

Petitioner was receiving Hizentra infusions as of the last medical records filed in April 2022. *See generally* Pet. Ex. 28.

C. Petitioner's Affidavits

Petitioner submitted three affidavits. Pet. Ex. 2; Pet. Ex. 12; Pet. Ex. 17.

She confirmed receipt of the flu vaccination on November 3, 2018. Prior to her receipt of the vaccination, she was active and healthy with no myositis, polymyositis, or dermatomyositis. Pet. Ex. 2 at 1. Around November 26, 2018, she had pain and swelling in her fingers and in her cuticles as well as changes to her nail beds. *Id.* at 2. In the first week of December 2018, she noticed rashes on her lower right leg that progressively spread eventually to her lower left leg and both elbows. *Id.* at 3. An esthetician prescribed a steroid cream for the rashes. By the end of December 2018, she had pain and rashes on her ears then her chest. The rashes spread to both arms, shoulders, forehead, and nose. A doctor prescribed steroids, which a dermatologist

increased a week later. She underwent allergy testing, which revealed no allergies that were contributing to her symptoms. She received skin biopsies and was eventually diagnosed with DM on March 7, 2019. *Id.*

In May 2019, petitioner began having muscle pain and the rashes continued to spread. She also had jaw pain and hair loss/thinning. Pet. Ex. 2 at 4. She had a flare in June 2019 and went to the ER for muscle weakness, difficulty swallowing, and numbness and tingling in her lower extremities. *Id.* She began Imuran on July 10, 2019 which she took in addition to prednisone. *Id.*

Petitioner has since suffered from skin rashes, body swelling, weight gain from steroids, severe limitations when going outside, and severe flare ups with inability to walk up and down stairs or use the fine motor skills in her hands due to pain and swelling. She has missed time from work as a result of her symptoms. She was forced to quit her second job because the physical demands were extensive and caused exacerbations of her symptoms. She has suffered physically and emotionally and fears what her injury will do to her health in the future and her earning capacity now and in the future. She also struggles with day-to-day activities like cooking and cleaning. Pet. Ex. 2 at 2, 4-7; *see also* Pet. Ex. 12 at 2-3.

Petitioner provided additional context to photographs that were filed into evidence. She affirmed that there would be no medical records that would have detailed her thinning hair. Pet. Ex. 12 at 1. She stated that the photographs were taken by her at various points between September 2018 (prior to vaccination) to present. *Id.* at 2; Pet. Ex. 9(a); Pet. Ex. 9(b); Pet. Ex. 9(c); Pet. Ex. 10; Pet. Ex. 17.

IV. Expert Opinions

A. Petitioner's Expert, Dr. Eric Gershwin

Dr. Gershwin wrote two reports in this matter. Pet. Ex. 18; Pet. Ex. 22.

In summarizing her medical history, Dr. Gershwin noted that prior to November 3, 2018, petitioner had no history of autoimmunity or muscle disorder. Pet. Ex. 18 at 1-3. Therefore, the issue here is whether a flu vaccine can cause the immunologically inflammatory disease DM, which Dr. Gershwin opined it can and did here. *Id.*

Dr. Gershwin described DM as a rare disease with multifactorial etiology that “requires genetic predisposition superimposed on environmental factors” with environmental factor(s) triggering the breakdown of immune tolerance but with no known “smoking gun”. Pet. Ex. 18 at 3-4. It is one of several idiopathic inflammatory myopathies (“IIMs”) with a central pathogenic feature involving excessive activation of the innate immune system leading to secondary

dysregulation of the adaptive immune response. *Id.* at 3; Pet. Ex. 20(a);¹⁶ Pet. Ex. 20(b);¹⁷ Pet. Ex. 20(c);¹⁸ Pet. Ex. 20(d);¹⁹ Pet. Ex. 20(e);²⁰ Pet. Ex. 20(f);²¹ Pet. Ex. 20(g).²²

Dr. Gershwin cited studies focusing on cytokines and chemokines in the blood, serum, muscle tissue, and skin of patients with IIMs where co-stimulation, immune cell activation, and transmigration of inflammatory cells lead to a persistent inflammatory response. Pet. Ex. 18 at 4; Pet. Ex. 20(s);²³ Pet. Ex. 20(t).²⁴ Skin biopsies of DM patients reveal the presence of CD4+ T cells producing IL-2 and interferon (“IFN”)-regulated proteins (IL-2, IFN-gamma, and/or IL-4). Pet. Ex. 18 at 3; Pet. Ex. 20(i);²⁵ Pet. Ex. 20(l).²⁶ Use of medication that suppresses IFN in blood and tissue in DM patients correlates with “target neutralization and clinical improvement” of the disease. Pet. Ex. 18 at 3-4; Pet. Ex. 20(m).²⁷

Dr. Gershwin acknowledged that epidemiology has not demonstrated any causative factor of DM, which is expected because DM is rare with an incidence of 2 per million per year. Pet. Ex. 18 at 4-5; Pet. Ex. 20(y).²⁸ Nevertheless, he stated infection is the most common etiological agent capable of inducing DM and described several mechanisms by which an infection could induce DM as follows:

Firstly, the infectious agent could potentially interact with self proteins, which then become novel and neo-antigens. Second, the infectious agent might render an otherwise sequestered antigen, exposed and accessible to an immune response. Third, there may be cross reactivity between an infectious agent and self-proteins,

¹⁶ Hornung & Wenzel, *supra* note 4.

¹⁷ Sahil Khanna, MBBS & Ann M. Reed, MD, *Immunopathogenesis of Juvenile Dermatomyositis*, 41 MUSCLE NERVE 581 (2010), filed as “Pet. Ex. 20(b)”.

¹⁸ Kanneboyina Nagaraju, DVM, PhD & Ingrid E. Lundberg, MD, PhD, *Polymyositis and Dermatomyositis: Pathophysiology*, 37 RHEUMATIC DISEASE CLINICS OF NORTH AMERICA 159 (2011), filed as “Pet. Ex. 20(c)”.

¹⁹ Francesca Meda et al., *The Epigenetics of Autoimmunity*, 8 CELLULAR & MOLECULAR IMMUNOLOGY 226 (2011), filed as “Pet. Ex. 20(d)”.

²⁰ Carlo Selmi et al., *Heritability Versus the Role of the Environment in Autoimmunity*, 39 J. AUTOIMMUNITY 249 (2012), filed as “Pet. Ex. 20(e)”.

²¹ Carlo Selmi, *The Worldwide Gradient of Autoimmune Conditions*, 9 AUTOIMMUNITY REV. A247 (2010), filed as “Pet. Ex. 20(f)”.

²² Frederick W. Miller et al., *Criteria for Environmentally Associated Autoimmune Diseases*, 39 J. AUTOIMMUNITY 253 (2013), filed as “Pet. Ex. 20(g)”.

²³ E.M. Moran & F.L. Mastaglia, *Cytokines in Immune-Mediated Inflammatory Myopathies: Cellular Sources, Multiple Actions and Therapeutic Implications*, 178 CLINICAL AND EXPERIMENTAL IMMUNOLOGY 405 (2014), filed as “Pet. Ex. 20(s)”.

²⁴ Marinos C. Dalakas, *Mechanisms of Disease: Signaling Pathways and Immunobiology of Inflammatory Myopathies*, 2 NATURE CLINICAL PRACTICE RHEUMATOLOGY 219 (2006), filed as “Pet. Ex. 20(t)”.

²⁵ Steven A. Greenberg, MD et al., *Interferon- α/β -Mediated Innate Immune Mechanisms in Dermatomyositis*, 57 ANNALS NEUROLOGY 664 (2005), filed as “Pet. Ex. 20(i)”.

²⁶ M. Caproni et al., *Clinical and Laboratory Investigations: Infiltrating Cells, Related Cytokines and Chemokine Receptors in Lesional Skin of Patients with Dermatomyositis*, 151 BRITISH J. DERMATOLOGY 784 (2004), filed as “Pet. Ex. 20(l)”.

²⁷ Brandon W. Higgs et al., *A Phase 1b Clinical Trial Evaluating Sifalimumab, an Anti-IFN- α Monoclonal Antibody, Shows Target Neutralisation of a Type 1 IFN Signature in Blood of Dermatomyositis and Polymyositis Patients*, 73 ANNALS RHEUMATIC DISEASES 256 (2014), filed as “Pet. Ex. 20(m)”.

²⁸ Peter N. Malleson et al., *The Incidence of Pediatric Rheumatic Diseases: Results from the Canadian Pediatric Rheumatology Association Disease Registry*, 23 J. RHEUMATOLOGY 1981 (1996), filed as “Pet. Ex. 20(y)”.

in this case, muscle antigens. In addition, infectious agents may produce non-specific activation of otherwise low affinity autoreactive cells and lead to their expansion. Other mechanisms include the ability of micro antigens to induce apoptosis and thence present such apoptotic cells to host immunity. Finally, other potential mechanisms can include an aberrant cytokine response that facilitates loss of tolerance in genetically susceptible hosts.

Pet. Ex. 18 at 5.

Dr. Gershwin likened the body's response to infection to its response to vaccination. He submitted that there was no evidence of infection in this case, thus leaving the vaccination as the most likely trigger. Pet. Ex. 18 at 5. Because vaccinations are "designed to fool the body into thinking it is responding to an infection", the biologic mechanisms following vaccination would be similar to the mechanisms incriminated in infection-induced DM. *Id.*; Pet. Ex. 21(e) at 4;²⁹ Pet. Ex. 21(h) at 2-3;³⁰ Pet. Ex. 21(n) at 1-3.³¹

Dr. Gershwin further relied on mouse studies wherein genetically susceptible mice are vaccinated with a muscle autoantigen found in myositis referred to as Jo-1 (histidyl-tRNA synthetase). The mice had autoantibodies fourteen days following vaccination; eight weeks after vaccination, muscle biopsy showed an increase in antibody titers with muscle histopathology demonstrating inflammatory cells and occasionally interstitial lung inflammation similar to patients with DM. Pet. Ex. 18 at 6; Pet. Ex. 21(c).³² He argued that this timing is consistent with the onset of petitioner's symptoms following vaccination. Pet. Ex. 18 at 6.

According to Dr. Gershwin, petitioner was genetically predisposed to DM. The genetic basis of autoimmunity is complex and includes the possibility of epigenetic modification. Pet. Ex. 18 at 6; Pet. Ex. 20(x).³³ Dr. Gershwin cited to *Dhiman*, a study on measles vaccination, to illustrate the upregulation of genes following vaccination and the diversity in responses among individuals who received the vaccine. Pet. Ex. 18 at 6; Pet. Ex. 21(d).³⁴ Some of the genes that were upregulated were involved in immunity, while others signaled transduction, apoptosis, proliferation of cells, and metabolic pathways. Other genes underwent downregulation. *Id.* Dr. Gershwin claimed that recent estimates of human T cell receptor diversity suggest 100 million different antigen receptors in a naïve T cell pool, meaning that the more people are immunized or exposed to antigens, the higher the likelihood that a given individual will have a response sufficient to be pathologic. Pet. Ex. 18 at 6.

²⁹ Marie Wahren-Herlenius & Thomas Dörner, *Immunopathogenic Mechanisms of Systemic Autoimmune Disease*, 382 LANCET 819 (2013), filed as "Pet. Ex. 21(e)".

³⁰ Arie Altman et al., *HBV Vaccine and Dermatomyositis: Is There an Association?*, 28 RHEUMATOLOGY INT'L 609 (2008), filed as "Pet. Ex. 21(h)".

³¹ David C. Wraith et al., *Vaccination and Autoimmune Disease: What is the Evidence?*, 362 LANCET 1659 (2003), filed as "Pet. Ex. 21(n)".

³² Yasuhiro Katsumata et al., *Species-Specific Immune Responses Generated by Histidyl-tRNA Synthetase Immunization are Associated with Muscle and Lung Inflammation*, 29 J. AUTOIMMUNITY 174 (2007), filed as "Pet. Ex. 21(c)".

³³ Dimitrios P. Bogdanos et al., *Twin Studies in Autoimmune Disease: Genetics, Gender and Environment*, 38 J. AUTOIMMUNITY J156 (2012), filed as "Pet. Ex. 20(x)".

³⁴ Neelam Dhiman et al., *Immune Activation at Effector and Gene Expression Levels After Measles Vaccination in Healthy Individuals: A Pilot Study*, 66 HUMAN IMMUNOLOGY 1125 (2005), filed as "Pet. Ex. 21(d)".

Dr. Gershwin proposed that the flu vaccine acted as the environmental trigger that activated the innate immune system, specifically a unique interferon signature in a genetically predisposed individual, which then facilitated presentation of autoantigens to plasmacytoid dendritic populations. Pet. Ex. 18 at 3-4, 7-8. *Wahren-Herlenius & Dörner* explained that “[i]n the breaking of tolerance, the initiating tissue—including dendritic cells—provides a decisive microenvironment that affects immune-cell differentiation, leading to activation of adaptive immunity.” Pet. Ex. 21(e) at 1.³⁵

Further, Dr. Gershwin argued the flu vaccine invoked interferon and cytokine production that “can lead to immune activation in genetically susceptible individuals.” Pet. Ex. 18 at 7. Relying on various studies, including *Wahren-Herlenius*, Dr. Gershwin explained that vaccinations activate the innate immune system and trigger the production of type 1 IFNs which then activate T and B cells. B cell autoantibodies respond by producing more type 1 IFNs, thereby beginning a self-sustaining loop of inflammation that eventually leads to tissue damage in DM patients. The adaptive immune system becomes dysregulated in DM patients, which allows the loop to continue. *Id.* at 3; Pet. Ex. 20(a);³⁶ Pet. Ex. 20(h);³⁷ Pet. Ex. 21(e).³⁸ The fact that there is a “strong expression of [IFN]-regulated proteins detected in muscle and skin” of DM patients supports that IFNs play a role in the disease pathogenesis. Pet. Ex. 18 at 3; Pet. Ex. 20(i) at 12-13.³⁹

Dr. Gershwin submitted that there are various environmental factors that can trigger DM, including ultraviolet radiation, smoking, infectious agents, vaccinations, medications, and even stress/trauma. Pet. Ex. 21(e) at 3-4;⁴⁰ Pet. Ex. 23(g) at 11.⁴¹ He acknowledged there is not a significant increase of DM after vaccination campaigns and epidemiology has not shown vaccination to be causative of DM. Pet. Ex. 18 at 6. However, he did not find this surprising given the rarity of DM. He explained that epidemiologic studies have insufficient power to detect an increased risk of DM from vaccination in those with a genetic background. *Id.* at 3, 4-5, 6, 7.

Dr. Gershwin disagreed with Dr. Maverakis’ opinion that the onset of petitioner’s DM was prior to her receipt of the flu vaccine. Pet. Ex. 22 at 1. He argued that there was no medical record to support an onset of muscle involvement or rash prior to the flu vaccination and no physician that indicated that she had onset of DM prior to her receipt of the flu vaccine. Further, although Dr. Gershwin agreed that the rash can manifest after the muscle issues, he submitted that DM generally begins with skin manifestations including papules over the fingers, erythema over the elbows and knees, heliotrope around the eyes, periungual telangiectasias, and dystrophic

³⁵ *Wahren-Herlenius & Dörner*, *supra* note 29.

³⁶ *Hornung & Wenzel*, *supra* note 4.

³⁷ J. Wenzel et al., *Evidence for a Role of Type I Interferons in the Pathogenesis of Dermatomyositis*, 153 *BRITISH J. DERMATOLOGY* pp440 (2005), filed as “Pet. Ex. 20(h)”.

³⁸ *Wahren-Herlenius & Dörner*, *supra* note 29.

³⁹ *Greenberg et al.*, *supra* note 25.

⁴⁰ *Wahren-Herlenius & Dörner*, *supra* note 29.

⁴¹ Ruth Ann Vleugels & Jeffrey P. Callen, *Dermatomyositis*, in *Dermatological Signs of Internal Disease*, filed as “Pet. Ex. 23(g)”.

cuticles. Further, muscle involvement initially manifests as proximal muscle weakness, not in the arms and legs. *Id.* at 1-2; Pet. Ex. 23(a).⁴²

Likewise, Dr. Gershwin disagreed that sunlight was a more likely cause of petitioner's DM. He pointed out that DM commonly presents on photosensitive sites regardless of the initial cause. Further, there was no evidence of a change in petitioner's sunlight exposure prior to onset of her DM. Pet. Ex. 22 at 3-4; Pet. Ex. 23(f);⁴³ Pet. Ex. 23(g);⁴⁴ Pet. Ex. 23(h);⁴⁵ Pet. Ex. 23(i).⁴⁶

Dr. Gershwin noted that Dr. Maverakis relied heavily on epidemiology but did not discuss power calculations or the difficulty in identifying rare events. To that, Dr. Gershwin reiterated that there are epidemiological challenges in studying rare diseases. He cited to a study that stated over 350 million people worldwide suffer from rare diseases. With the prevalence of each disease being low, it is difficult to identify and forecast rare events especially when some rare diseases are infectious and others autoimmune. Pet. Ex. 22 at 2-3; Pet. Ex. 23(b);⁴⁷ Pet. Ex. 23(c);⁴⁸ Pet. Ex. 23(d);⁴⁹ Pet. Ex. 23(e).⁵⁰

In summarizing, Dr. Gershwin submitted that DM is the result of both hyperactivation of the innate immune system and dysregulation of the adaptive immune system with a breakdown of tolerance contributing to a feedback loop where autoimmune amplification produces excessive IFN and autoantibodies. Pet. Ex. 18 at 3. Petitioner received the flu vaccine which activated her immune system and in particular her unique interferon signature, thereby facilitating antigen presentation of autoantigens to plasmacytoid dendritic cells, leading to an inflammatory response within petitioner's skin and muscle. *Id.* at 7. Onset of 2-3 weeks between vaccination and the appearance of immunopathology is consistent with the proposed mechanism. *Id.* at 8. Therefore, within a reasonable degree of medical probability, the flu vaccine triggered the onset of petitioner's DM. *Id.*

⁴² Umaina Marvi et al., *Clinical Presentation and Evaluation of Dermatomyositis*, 57 INDIAN J. DERMATOLOGY 375 (2012), filed as "Pet. Ex. 23(a)".

⁴³ W.K. Cheong et al., *Cutaneous Photosensitivity in Dermatomyositis*, 131 BRITISH J. DERMATOLOGY 205 (1994), filed as "Pet. Ex. 23(f)".

⁴⁴ Vleugels & Callen, *supra* note 41.

⁴⁵ L. Dourmishev et al., *Dermatomyositis: Comparative Studies of Cutaneous Photosensitivity in Lupus Erythematosus and Normal Subjects*, 20 PHOTODERMATOLOGY, PHOTOIMMUNOLOGY & PHOTOMEDICINE 230 (2004), filed as "Pet. Ex. 23(h)".

⁴⁶ Yoshinao Muro et al., *Cutaneous Manifestations in Dermatomyositis: Key Clinical and Serological Features—A Comprehensive Review*, 51 CLINICAL REV. IN ALLERGY & IMMUNOLOGY 293 (2016), filed as "Pet. Ex. 23(i)".

⁴⁷ Rich Colbaugh et al., *Learning to Identify Rare Disease Patients from Electronic Health Records*, 2018 AMIA ANNUAL SYMPOSIUM PROCEEDINGS 340 (2018), filed as "Pet. Ex. 23(b)".

⁴⁸ Eric W. Schoon et al., *Precluding Rare Outcomes by Predicting Their Absence*, 14 PLOS ONE e0223239 (2019), filed as "Pet. Ex. 23(c)".

⁴⁹ Branimir K. Hackenberger, *Rare, Rarer, It Still Has Not Happened*, 60 CROATIAN MEDICAL J. 565 (2019), filed as "Pet. Ex. 23(d)".

⁵⁰ Najmeh Alirezaie et al., *ClinPred: Prediction Tool to Identify Disease-Relevant Nonsynonymous Single-Nucleotide Variants*, 103 AM. J. HUM. GENETICS 474 (2018), filed as "Pet. Ex. 23(e)".

B. Respondent's Expert, Dr. Emmanuel Maverakis

Dr. Maverakis filed two expert reports in this matter. Resp. Ex. A; Resp. Ex. C. He agreed that DM is the appropriate diagnosis. Resp. Ex. A at 7.

Dr. Maverakis referred to DM as a rare disease with only a few patients developing it each year. However, he submitted that with 150 million flu vaccines administered annually, it is not surprising that a handful of DM cases are reported following flu vaccination. Resp. Ex. A at 8. Dr. Maverakis maintained that the flu vaccine as a trigger for DM can be studied and proposed that it can be done by looking at vaccine campaigns. For example, there was the 1976 influenza campaign and the A/NJ/76 swine flu vaccine with no increase in DM detected; specifically, nearly 1 million military personnel received the swine flu vaccine with no increase in DM reported. Likewise, the Mayo Clinic, the Cleveland Clinic, Cleveland Metropolitan Hospital, and Massachusetts General Hospital did not report DM following flu vaccine during the same period. Resp. Ex. A at 8; Resp. Ex. A Tab 1.⁵¹ Further, DM is a lifelong disease. Therefore, a causal relationship between DM and flu vaccine could be determined by the rate of exacerbation in existing patients following vaccination. Yet, no “convincing link” has been established, and flu vaccine is recommended for patients with DM. Resp. Ex. A at 8 (internal citations omitted). Dr. Maverakis argued that studies investigating whether the flu vaccine was a “more likely than not” cause of DM could be performed although they “might require more individuals as data curation and accuracy in documentation might be suboptimal.” *Id.* at 9.

However, Dr. Maverakis later conceded that “it is difficult to conduct epidemiologic studies on extremely rare diseases” like DM. He further conceded that “if an association does exist between the influenza vaccination and [DM], it would be very difficult to identify the association for the reasons outlined by Dr. Gershwin.” Resp. Ex. C at 1.

Dr. Maverakis suggested that the onset of petitioner's DM was prior to her receipt of the flu vaccination based on a questionnaire petitioner filled out on January 19, 2018 in which she responded “yes” to having motor symptoms, shooting and/or radiating pain into her arms and/or legs, and numbness or weakness. Resp. Ex. A at 8. He therefore concluded that petitioner “was clearly having some issues” with muscle involvement prior to receiving the subject vaccine. *Id.* at 8, 9.

Further, Dr. Maverakis referred to the rash distribution seen on the photographs petitioner filed and documented in the medical record as strong evidence that petitioner's DM was triggered by sun exposure. He cited the March 7, 2019 dermatology record that documented “photodermatitis” on petitioner's arms, chest, and face. Resp. Ex. A at 8; Pet. Ex. 4 at 5-8. He explained that photo-distributed rashes “can only be caused by light, which is a known environmental trigger for [DM].” Resp. Ex. A at 8. In his opinion, that is “clearly what happened in the Petitioner's case.” *Id.*

Dr. Maverakis agreed that a reasonable temporal association existed between receipt of the flu vaccination and the onset of petitioner's rash. He disagreed that the mouse study relied on

⁵¹ Ellen M. Kurland et al., *Lack of Association of A/NJ/76 (Swine Flu) Vaccine and Polymyositis*, 4 NEUROEPIDEMIOLOGY 125 (1985), filed as “Resp. Ex. A Tab 1”.

by Dr. Gershwin could be extrapolated to petitioner's case. Unlike petitioner, the mice in the study were injected with a self-antigen. "There is no experimental evidence that immunizing autoimmune-susceptible mice against influenza results in dermatomyositis." Resp. Ex. A at 9.

Dr. Maverakis agreed with Dr. Gershwin that genetic polymorphisms found within the innate and adaptive immune systems and their signaling and effector pathways in patients with systemic autoimmunity can lead to lowered signaling thresholds and create a feedforward loop that sustains inflammation and disease. However, he added that these pathways can be triggered by sunlight, which he opined happened here as "evident by the Petitioner's rash." Resp. Ex. A at 9-10.

Dr. Maverakis addressed Dr. Gershwin's reliance on *Perdan-Pirkmajer*, submitting that the study showed no significant difference in autoimmune titers between vaccinated and unvaccinated patient groups and was "strong evidence" that the flu vaccine was a less likely cause of petitioner's DM. Resp. Ex. A at 10; Resp. Ex. A Tab 3.⁵²

Dr. Maverakis further submitted that "while type I interferons appear to be upregulated in dermatomyositis and likely play a role in the disease, they are not strong drivers of the disease pathophysiology." He argued that the interferon blocking medication Dr. Gershwin referred to as showing clinical improvement in DM patients was discontinued for failing to demonstrate efficacy. Resp. Ex. A at 9.

Dr. Maverakis described Dr. Gershwin's theory as "entirely speculative" and "theoretical". He based this conclusion on the lack of measurements taken following vaccination, thus he stated there was no evidence to support that petitioner's autoimmunity developed as a result of the vaccination. Resp. Ex. A at 10. Rather, it was his opinion that "sunlight could have initiated the autoimmune process." *Id.*; Resp. Ex. C at 2.

Dr. Maverakis maintained his opinion that the flu vaccine was not "more likely than not" a cause of petitioner's DM. Resp. Ex. C at 1. He explained that for him to determine whether something is "more likely than not" the cause of something else, "the relative risk must be greater than 2, which is an extremely high association." *Id.* at 1-2. Dr. Maverakis stated that such an association between flu vaccination and DM has not been established despite high flu vaccination rates. *Id.* at 2.

In summary, Dr. Maverakis' opinion was that the flu vaccine was not more likely than not the cause of petitioner's DM, sunlight was. Resp. Ex. A at 10; Resp. Ex. C at 2.

⁵² K Perdan-Pirkmajer et al., *Autoimmune Response Following Influenza Vaccination in Patients with Autoimmune Inflammatory Rheumatic Disease*, 21 LUPUS 175 (2012), filed as "Pet. Ex. 21(l)" and "Resp. Ex. A Tab 3".

V. The Parties' Submissions

A. Petitioner's Motion for Ruling on the Record

Petitioner submitted that there are three primary issues to be determined: 1) whether petitioner's onset of DM began within six weeks of receiving the influenza vaccine; 2) whether her DM was causally related to the influenza vaccine; and 3) whether respondent has provided preponderant evidence of an alternative cause of petitioner's DM. Motion at 4.

Petitioner relied on Dr. Gershwin's opinion that but for her influenza vaccine, petitioner "would not have developed dermatomyositis." Motion at 14. Dr. Gershwin described DM as a rare disease requiring genetic predisposition superimposed on environmental factors. *Id.* However, classic epidemiologic studies are not sufficiently powered to detect differences in diseases as rare as DM and are therefore not probative in evaluating the causal link between the flu vaccine and DM. *Id.*

Petitioner submitted that Dr. Gershwin opined that while the exact causes of the inflammation in idiopathic inflammatory myopathies are not precisely known, autoimmune mechanisms involving inappropriate activation of the innate immune system leading to secondary dysregulation of the adaptive response is considered central to pathogenic features of inflammatory myopathies. Motion at 14. This cycle of inflammation affects skin, muscle, and internal organs. *Id.* Petitioner then quoted much of Dr. Gershwin's report through his conclusion that an inflammatory loop is created with interferon promoting and sustaining autoreactive responses, thereby keeping T and B cells activated in a vicious cycle producing autoantibodies and resulting in DM. *Id.* at 14-17.

Petitioner argued that applying Dr. Gershwin's theory, petitioner's receipt of the flu vaccine activated her immune system and her unique interferon signature, thus facilitating antigen presentation of autoantigens to plasmacytoid dendritic populations and breaking immune tolerance which ultimately led to the inflammatory response of DM. Motion at 17-18. Her onset of DM two to three weeks after vaccination is consistent with the mechanisms Dr. Gershwin proposed. *Id.* at 18.

Petitioner then detailed Dr. Maverakis' opinions, specifically that her onset of DM occurred prior to her flu vaccine and that sunlight rather than the flu vaccine was the trigger based on the pattern of her rash. Motion at 18-22.

Petitioner argued at length that Dr. Gershwin provided a sound and reliable theory on how the flu vaccine can cause DM; how the evolution of petitioner's symptoms of rash and muscle weakness were consistent with the flu vaccine being the cause of her DM; and how petitioner's onset 2-3 weeks after vaccination was consistent with Dr. Gershwin's proposed mechanism. Motion at 28-41.

Petitioner further cited two prior cases in the Program involving DM, one where the petitioner had juvenile DM and successfully proved causation (*Rodriguez v. Sec'y of Health & Human Servs.*, No. 13-253V, 2017 WL 5563419 (Fed. Cl. Spec. Mstr. Oct. 26, 2017)) and the

other where the petitioner failed to prove causation largely because onset was too late to infer that the vaccine was the cause (*Whelan v. Sec’y of Health & Human Servs.*, No. 16-1174V, 2019 WL 1061473 (Fed. Cl. Spec. Mstr. Jan. 28, 2019)).⁵³ Motion at 44-48.

Petitioner concluded that she had satisfied all three *Althen* prongs, and respondent failed to carry his burden in proving an alternative cause. Thus, she is entitled to compensation. Motion at 41-43, 48-49.

B. Respondent’s Response

Respondent argued that Dr. Gershwin had failed to provide a scientifically reliable theory causally connecting the flu vaccine and DM, had not demonstrated a logical sequence of cause and effect, and failed to provide a medically acceptable temporal relationship between petitioner’s November 3, 2018 flu vaccine and her DM. Response at 7-8.

Respondent argued that Dr. Gershwin’s opinions were speculative and that the medical literature that studied the association between vaccines and DM found no causal link. Response at 8-9. Respondent further argued that Dr. Gershwin admitted that no literature existed that showed DM following flu vaccine after large vaccination campaigns. The flu vaccine is recommended for those with active DM. *Id.* at 10. Dr. Maverakis explained that because DM is a chronic disease, it is possible to study the association between flu vaccination and DM. *Id.*

Respondent argued that other than HPV vaccine, no vaccine has been found to be associated with DM flares. However, the most significant environmental risk factors for DM and DM flare are sun exposure and medications like NSAIDs. Response at 8. While petitioner did present case reports of DM following flu vaccine, case reports do not provide reliable evidence of causation. *Id.* at 11-13.

Further, Dr. Gershwin relied on an assumption that petitioner had an unknown or unrecognized genetic predisposition that caused her immune system to be activated and to produce an unknown and speculative “unique ‘interferon signature’” that facilitated antigen presentation of autoantigens to plasmacytoid dendritic populations which led to an inflammatory response of skin and muscle in the form of DM. Response at 13-14. According to respondent, there is no evidence that petitioner had a genetic predisposition. *Id.* at 14. Further, interferon is not a strong driver of the DM disease process. *Id.* at 14-15. Petitioner’s theory is speculative and none of her treating physicians attributed her DM to her flu vaccine. *Id.* at 13-14, 16.

Finally, respondent argued that there is overwhelming evidence that sunlight can trigger DM which is likely what happened here. Response at 16. “Dr. Gershwin made no effort to

⁵³ In both her Motion and Reply, petitioner argued I already decided the flu vaccine can cause DM based on *Rodriguez*. However, as noted in the Rule 5 Order, *Rodriguez* involved juvenile dermatomyositis following Tdap, MMR, Polio, and Varicella vaccinations. See ECF No. 38. Thus, despite petitioner’s contention, I have not yet decided whether flu vaccine can cause dermatomyositis. Nevertheless, even if I had determined in a prior case that a flu vaccine caused DM, prior opinions of a special master—including myself—are not binding. See *Boatmon v. Sec’y of Health & Human Servs.*, 941 F.3d 1351, 1358 (Fed. Cir. 2019).

reasonably rule out sunlight as a cause of petitioner’s DM.” *Id.* Further, there is evidence that petitioner’s DM began prior to vaccination. *Id.* at 18.

Therefore, petitioner’s claim fails under all three *Althen* prongs, and her claim must be denied. Response at 18.

C. Petitioner’s Reply

In her Reply, petitioner argued that respondent “heightened Petitioner’s burden of proof in proving causation” by arguing petitioner’s claim fails based on the lack of epidemiological support. Reply at 3. Petitioner did not dispute that there is no epidemiological evidence proving a link between the flu vaccine and DM. *Id.* However, neither epidemiology nor scientific certainty is required to prove causation in the Program. *Id.* at 4-6, 15 (citations omitted). Further, petitioner argued that respondent “distort[ed] the medical records in an attempt to create an earlier onset of dermatomyositis when contesting Althen Prong 3”. *Id.* at 15, 18-20. Finally, respondent failed to point to any evidence that sunlight caused petitioner’s DM. *Id.* at 22.

VI. Legal Standard

A petitioner is required to establish his case by a preponderance of the evidence. 42 U.S.C. § 300aa-13(1)(a). The preponderance of the evidence standard requires a “trier of fact to believe that the existence of a fact is more probable than its nonexistence before [they] may find in favor of the party who has the burden to persuade the judge of the fact’s existence.” *Moberly v. Sec’y of Health & Human Servs.*, 592 F.3d 1315, 1322 n.2 (Fed. Cir. 2010) (citations omitted). Proof of medical certainty is not required. *Bunting v. Sec’y of Health & Human Servs.*, 931 F.2d 867, 873 (Fed. Cir. 1991).

Distinguishing between “preponderant evidence” and “medical certainty” is important because a special master should not impose an evidentiary burden that is too high. *Andreu v. Sec’y of Health & Human Servs.*, 569 F.3d 1367, 1379-80 (Fed. Cir. 2009) (reversing a special master’s decision that petitioners were not entitled to compensation); *see also Lampe v. Sec’y of Health & Human Servs.*, 219 F.3d 1357 (Fed. Cir. 2000); *Hodges v. Sec’y of Health & Human Servs.*, 9 F.3d 958, 961 (Fed. Cir. 1993) (disagreeing with the dissenting judge’s contention that the special master confused preponderance of the evidence with medical certainty).

The Vaccine Act provides two avenues for petitioners to receive compensation. First, a petitioner may demonstrate a “Table” injury—i.e., an injury listed on the Vaccine Injury Table that occurred within the provided time period. 42 U.S.C. § 300aa-11(c)(1)(C)(i). “In such a case, causation is presumed.” *Capizzano v. Sec’y of Health & Human Servs.*, 440 F.3d 1317, 1320 (Fed. Cir. 2006); *see* § 13(a)(1)(B). Second, where the alleged injury is not listed on the Vaccine Injury Table, a petitioner may demonstrate an “off-Table” injury, which requires that the petitioner “prove by a preponderance of the evidence that the vaccine at issue caused the injury.” *Capizzano*, 440 F.3d at 1320; *see* § 11(c)(1)(C)(ii); *see also Wright v. Sec’y of Health & Human Servs.*, 22 F.4th 999, 1006 (Fed. Cir. 2022) (defining the term “residual effects” in the Act, as “detrimental conditions within the patient, such as lingering or recurring signs and symptoms” of the alleged vaccine injury, which are compensable). A petitioner need not show that the

vaccination was the sole cause, or even the predominant cause, of the alleged injury; showing that the vaccination was a “substantial factor” and a “but for” cause of the injury is sufficient for recovery. *Pafford v. Sec’y of Health & Human Servs.*, 451 F.3d 1352, 1355 (Fed. Cir. 2006); *Shyface v. Sec’y of Health & Human Servs.*, 165 F.3d 1344, 1352 (Fed. Cir. 1999). Petitioners are not required “to eliminate alternative causes as part of establishing [their] prima facie case.” *Doe v. Sec’y of Health & Human Servs.*, 601 F.3d 1349, 1357-58 (Fed. Cir. 2010); see *Walther v. Sec’y of Health & Human Servs.*, 485 F.3d 1146, 1152 (Fed. Cir. 2007) (holding that a “petitioner does not bear the burden of eliminating alternative independent potential causes”). Once a petitioner has proven causation by preponderant evidence, “the burden then shifts to the respondent to show by a preponderance of the evidence that the injury is due to factors unrelated to the administration of the vaccine.” *Deribeaux ex rel. Deribeaux v. Sec’y of Health & Human Servs.*, 717 F.3d 1363, 1367 (Fed. Cir. 2013) (citing 42 U.S.C. § 300aa-13(a)(1)(B)).

To prove causation, a petitioner must satisfy the three-pronged test established in *Althen v. Sec’y of Health & Human Servs.*, 418 F.3d 1274 (Fed. Cir. 2005). *Althen* requires that a petitioner show by preponderant evidence that a vaccination they received caused their injury “by providing: (1) a medical theory causally connecting the vaccination and the injury; (2) a logical sequence of cause and effect showing that the vaccination was the reason for the injury; and (3) a showing of a proximate temporal relationship between vaccination and injury.” *Id.* at 1278. Together, these prongs must show “that the vaccine was ‘not only a but-for cause of the injury but also a substantial factor in bringing about the injury.’” *Stone v. Sec’y of Health & Human Servs.*, 676 F.3d 1373, 1379 (Fed. Cir. 2012) (quoting *Shyface*, 165 F.3d at 1352-53). Causation is determined on a case-by-case basis, with “no hard and fast per se scientific or medical rules.” *Knudsen v. Sec’y of Health & Human Servs.*, 35 F.3d 543, 548 (Fed. Cir. 1994). Petitioners are not required to identify “specific biological mechanisms” to establish causation, nor are they required to present “epidemiologic studies, rechallenge, the presence of pathological markers or genetic disposition, or general acceptance in the scientific or medical communities.” *Capizzano*, 440 F.3d at 1325 (quoting *Althen*, 418 F.3d at 1280). “[C]lose calls regarding causation are resolved in favor of injured claimants.” *Althen*, 418 F.3d at 1280.

Each *Althen* prong requires a different showing. Under the first prong, a petitioner must provide a “reputable medical theory” demonstrating that the vaccine received can cause the type of injury alleged. *Pafford*, 451 F.3d at 1355-56 (citation omitted). To satisfy this prong, a petitioner’s “theory of causation must be supported by a ‘reputable medical or scientific explanation.’” *Andreu*, 569 F.3d at 1379 (quoting *Althen*, 418 F.3d at 1278). This theory need only be “legally probable, not medically or scientifically certain.” *Id.* at 1380 (emphasis omitted) (quoting *Knudsen*, 35 F.3d at 548). Nevertheless, “petitioners [must] proffer trustworthy testimony from experts who can find support for their theories in medical literature.” *LaLonde*, 746 F.3d at 1341.

The second *Althen* prong requires proof of a “logical sequence of cause and effect.” *Capizzano*, 440 F.3d at 1326 (quoting *Althen*, 418 F.3d at 1278). Even if the vaccination can cause the injury, a petitioner must show “that it did so in [this] particular case.” *Hodges v. Sec’y of Health & Human Servs.*, 9 F.3d 958, 962 n.4 (Fed. Cir. 1993) (citation omitted). “A reputable medical or scientific explanation must support this logical sequence of cause and effect,” *Id.* at 961 (citation omitted), and “treating physicians are likely to be in the best position to determine

whether a logical sequence of cause and effect show[s] that the vaccination was the reason for the injury,” *Paluck v. Sec’y of Health & Human Servs.*, 786 F.3d 1373, 1385 (Fed. Cir. 2015) (quoting *Andreu*, 569 F.3d at 1375).

The third *Althen* prong requires that a petitioner establish a “proximate temporal relationship” between the vaccination and the alleged injury. *Althen*, 418 F.3d at 1281. This “requires preponderant proof that the onset of symptoms occurred within a timeframe for which, given the medical understanding of the disorder’s etiology, it is medically acceptable to infer causation-in-fact.” *De Bazan v. Sec’y of Health & Human Servs.*, 539 F.3d 1347, 1352 (Fed. Cir. 2008). Typically, “a petitioner’s failure to satisfy the proximate temporal relationship prong is due to the fact that onset was too late after the administration of a vaccine for the vaccine to be the cause.” *Id.* However, “cases in which onset is too soon” also fail this prong; “in either case, the temporal relationship is not such that it is medically acceptable to conclude that the vaccination and the injury are causally linked.” *Id.*; see also *Locane v. Sec’y of Health & Human Servs.*, 685 F.3d 1375, 1381 (Fed. Cir. 2012) (“[I]f the illness was present before the vaccine was administered, logically, the vaccine could not have caused the illness.”).

Finally, although this decision discusses some but not all the literature in detail, I have reviewed and considered all of the medical records and literature submitted in this matter. See *Moriarty ex rel. Moriarty v. Sec’y of Health & Human Servs.*, 844 F.3d 1322, 1328 (Fed. Cir. 2016) (“We generally presume that a special master considered the relevant record evidence even though [s]he does not explicitly reference such evidence in h[er] decision.”); *Simanski v. Sec’y of Health & Human Servs.*, 115 Fed. Cl. 407, 436 (2014) (“[A] Special Master is ‘not required to discuss every piece of evidence or testimony in her decision.’” (citation omitted)), *aff’d*, 601 F. App’x 982 (Fed. Cir. 2015).

VII. Discussion

This case involves a unique circumstance wherein the experts “are not only friends and colleagues . . . but have published collaborative manuscripts and served as Co-Investigator[s] on NIH grants.” Pet. Ex. 22 at 1. Both experts have outstanding credentials and are well respected in their fields. The respect they showed for the other’s opinions was refreshing.

A. Petitioner Has Provided a Sound and Reliable Medical Theory

It is petitioner’s burden to prove a sound and reliable theory for how the subject vaccination can cause the injury alleged in this case. *Pafford*, 451 F.3d at 1355-56 (citation omitted).

Dr. Gershwin’s theory is taken directly from the literature which describes DM as of multifactorial etiology beginning with genetic predisposition then exposure to environmental triggers that eventually leads to the breakdown of tolerance by activating certain cellular pathways that contain disease-associated polymorphisms. Pet. Ex. 18 at 3, 7; Pet. Ex. 20(c) at 4-5;⁵⁴ Pet. Ex. 20(v) at 5, 7;⁵⁵ Pet. Ex. 21(e).⁵⁶ Dr. Gershwin pointed to the current understanding

⁵⁴ Nagaraju & Lundberg, *supra* note 18.

⁵⁵ Robinson & Reed, *supra* note 5.

that DM involves hyperactivation of the innate immune system, specifically in producing type 1 interferons which in turn activate T and B cells. B cell autoantibodies then stimulate production of type 1 interferons, thus creating a “feedforward loop” of continuous inflammation and ultimately resulting in tissue damage. Pet. Ex. 18 at 3; Pet. Ex. 20(a);⁵⁷ Pet. Ex. 20(h);⁵⁸ Pet. Ex. 21(e). Further, dysregulation of the adaptive immune system contributes to this loop. Pet. Ex. 18 at 3; Pet. Ex. 21(n) at 3-5.⁵⁹ Interferons are thought to play a role in the pathogenesis of DM because a “strong expression of [IFN]-regulated proteins [is] detected in muscle and skin.” Pet. Ex. 18 at 3; Pet. Ex. 20(i) at 12-13.⁶⁰ Dr. Gershwin applied this theory to the vaccination, explaining that an influenza vaccination would induce IFN production and trigger the process described above, “lead[ing] to immune activation in genetically susceptible individuals.” Pet. Ex. 18 at 7; Pet. Ex. 21(e).

Dr. Gershwin added that research shows the key cytokines in the blood, serum, muscle tissue, and skin of patients with inflammatory myositis “are produced by Th1 (i.e. IFN γ , IL-2, IL-12, TNF α), Th2 (i.e. IL-4 and IL-13), Th17 (i.e. IL-17, IL-22, IL-23, IL-6), and Treg (i.e. IL-10, TGF- β) cells. IL-1 family cytokines such as IL-1 α and β , and IFN α and β are also altered in IIM sera and tissues.” Pet. Ex. 18 at 4; Pet. Ex. 20(s).⁶¹ These molecules sustain inflammation through co-stimulation, immune cell activation, and transmigration of inflammatory cells, leading to the synthesis of soluble proinflammatory mediators and thus contributing to the persistence of the inflammatory response. Pet. Ex. 18 at 4; Pet. Ex. 20(t).⁶²

In other words, the flu vaccine acted as the environmental trigger that activated the innate immune system, specifically a unique interferon signature in a genetically predisposed individual, which then facilitated presentation of autoantigens to plasmacytoid dendritic populations. This immune response led to the breakdown of tolerance and contributed to a feedback loop wherein more interferon is produced, thus promoting inflammation and maintaining the activation of T and B cells in a “vicious cycle” of autoantibody production and resulting in the disease. Pet. Ex. 18 at 3-4, 7-8.

Dr. Gershwin relied on *Wahren-Herlenius & Dörner* which described various environmental factors that trigger DM “via immune pathways or by induction of apoptosis”, such as ultraviolet radiation, smoking, and infectious agents. Pet. Ex. 21(e) at 3-4.⁶³ Similarly, *Vleugels & Callen* stated that several agents have been associated with the appearance of DM, “including various infections (particularly viral or parasitic infections), vaccination, neoplasms, drug-induced disease, various types of stress, and trauma.” Pet. Ex. 23(g) at 11.⁶⁴

Dr. Gershwin provided various mechanisms by which infectious agents can induce dermatomyositis. Pet. Ex. 18 at 5. These biological mechanisms may occur as a response to any

⁵⁶ Wahren-Herlenius & Dörner, *supra* note 29.

⁵⁷ Hornung & Wenzel, *supra* note 4.

⁵⁸ Wenzel et al., *supra* note 37.

⁵⁹ Wraith et al., *supra* note 31.

⁶⁰ Greenberg et al., *supra* note 25.

⁶¹ Moran & Mastaglia, *supra* note 23.

⁶² Dalakas, *supra* note 24.

⁶³ Wahren-Herlenius & Dörner, *supra* note 29.

⁶⁴ Vleugels & Callen, *supra* note 41.

environmental trigger. *Id.*; Pet. Ex. 21(h) at 2-3 (describing several causal mechanisms thought to induce autoimmunity and stating “[t]hese mechanisms may also be operative in the case of vaccination, where an antigen of a recombinant vaccine, or a live attenuated virus, may trigger autoimmune responses.”).⁶⁵ One potential mechanism for infection to trigger autoimmunity is molecular mimicry where proteins in the infectious agent cross-react with self-proteins. Pet. Ex. 18 at 5. Additionally, the infectious agent may render a previously sequestered antigen exposed and vulnerable to an immune response. *Id.* An infectious agent may also produce non-specific activation of “low affinity autoreactive cells and lead to their expansion.” *Id.* Alternatively, the body may have an “aberrant cytokine response” to an environmental trigger that facilitates the loss of tolerance in a genetically predisposed person. *Id.*; see also Pet. Ex. 21(e) at 4; Pet. Ex. 21(h) at 2-3; Pet. Ex. 21(n) at 1-3.⁶⁶

Dr. Gershwin added that a variety of literature supports a link between vaccination and DM. Pet. Ex. 18 at 7; Pet. Ex. 21(h);⁶⁷ Pet. Ex. 21(i);⁶⁸ Pet. Ex. 21(j).⁶⁹ For instance, *Altman* was a case report discussing a child who developed DM a week after receiving a hepatitis B vaccine. Pet. Ex. 21(h). *Ferri* is a case report discussing three patients, two who developed polymyositis with interstitial lung disease after flu vaccine and one who developed dermatomyositis after flu vaccine. Pet. Ex. 21(i). Finally, Dr. Gershwin cited to *Jani*, which is another case report involving DM after flu vaccine. Pet. Ex. 21(j).

Dr. Gershwin conceded that the literature does not support a significant increase in DM after large vaccine campaigns. Pet. Ex. 18 at 6. However, he did not find this surprising given the rarity of DM. Pet. Ex. 18 at 7. For the same reason, epidemiologic studies have insufficient power to detect an increased risk of DM from vaccination, particularly when controlling for age and genetic background. *Id.* at 3, 4-5, 6, 7; Pet. Ex. 22 at 2-3; Pet. Ex. 23(b);⁷⁰ Pet. Ex. 23(c);⁷¹ Pet. Ex. 23(d);⁷² Pet. Ex. 23(e).⁷³

Dr. Maverakis agreed with the theory Dr. Gershwin proposed that genetic polymorphisms found within the innate and adaptive immune systems and their signaling and effector pathways in patients with systemic autoimmunity can lead to lowered signaling thresholds and create a feedforward loop that sustains inflammation and disease. Resp. Ex. A at 9-10. However, he stated that “these pathways can be triggered by sunlight”. *Id.*

Dr. Maverakis claimed that “while type I interferons appear to be upregulated in dermatomyositis and likely play a role in the disease, they are not strong drivers of the disease pathophysiology.” This was evident when the interferon blocking medication Dr. Gershwin used

⁶⁵ Altman et al., *supra* note 30.

⁶⁶ Wraith et al., *supra* note 31.

⁶⁷ Altman et al., *supra* note 30.

⁶⁸ Clodoveo Ferri et al., *Polymyositis Following Pandemic Influenza A (H1N1) and 2009-10 Seasonal Trivalent Vaccines*, 2012 CASE REPORTS IN RHEUMATOLOGY 1 (2012), filed as “Pet. Ex. 21(i)”.

⁶⁹ F.M. Jani et al., *Influenza Vaccine and Dermatomyositis*, 12 VACCINE 1484 (1994), filed as “Pet. Ex. 21(j)”.

⁷⁰ Colbaugh et al., *supra* note 47.

⁷¹ Schoon et al., *supra* note 48.

⁷² Hackenberger, *supra* note 49.

⁷³ Alirezaie et al., *supra* note 50.

to show interferon involvement in DM was discontinued due to a lack of efficacy. Resp. Ex. A at 9.

Dr. Maverakis argued that the literature does not support a link between the flu vaccination and DM. Resp. Ex. A at 8, 10. *Perdan-Pirkmajer*, submitted by Dr. Gershwin, demonstrated that “there is no significant difference in autoimmune titers” after flu vaccination. *Id.* at 10; Resp. Ex. A Tab 3.⁷⁴ Likewise, in a study of DM flares following environmental triggers, *Mamyrova* found that sun exposure and medications may play a role in disease flares but vaccines other than HPV vaccine were not significantly associated with flares. Resp. Ex. A Tab 6 at 5.⁷⁵ Further, he noted that flu vaccination is recommended for people with DM, weighing against a “strong causal link between vaccination and dermatomyositis.” Resp. Ex. A at 8; Resp. Ex. A Tab 7;⁷⁶ Resp. Ex. A Tab 8.⁷⁷

Dr. Maverakis referred to Dr. Gershwin’s theory that the flu vaccine activated the immune system, which ultimately led to the breakdown of tolerance and initiation of autoimmunity, as “entirely speculative” as it related to the vaccination as initiating the process. He argued instead that “[o]ther environmental triggers such as sunlight could have initiated the autoimmune process.” Resp. Ex. A at 10.

Dr. Maverakis conceded that DM is a rare disease, making it difficult to conduct the studies necessary to establish disease associations. Resp. Ex. A at 8; Resp. Ex. C at 1. He further conceded that if such an association exists between flu vaccination and DM, “it would be difficult to identify the association for reasons outlined by Dr. Gershwin.” Resp. Ex. C at 1.

Finally, in summarizing Dr. Maverakis’ opinion that sunlight was the more likely cause of petitioner’s DM, respondent argued that “Dr. Gershwin made no effort to reasonably rule out sunlight as a cause of petitioner’s DM.” Response at 16.

As a preliminary matter, petitioner need not prove that there is a clear causal link between flu vaccination and DM. Requiring that level of proof is akin to requiring scientific certainty, and the caselaw is clear that special masters may not elevate petitioner’s burden to require scientific certainty. *Andreu*, 569 F.3d at 1379-80; *Hodges*, 9 F.3d at 961. Further, if the science were clear, these claims would be on-Table; the very nature of an off-Table claim such as this is that science is not cut and dry for a variety of reasons discussed by both experts in this case. Yet, in creating an avenue for off-Table claims to be pursued, Congress clearly contemplated that some injuries may be compensable even in the absence of a clear link between vaccine and injury. Lastly, petitioner need not eliminate alternative causes to sustain her burden in proving causation. *Doe*, 601 F.3d at 1357-58; *Walther*, 485 F.3d at 1152. Rather, if petitioner proves causation-in-fact by a preponderance of evidence, she is entitled to compensation unless respondent meets his burden

⁷⁴ *Perdan-Pirkmajer et al.*, *supra* note 52.

⁷⁵ *Mamyrova et al.*, *supra* note 11.

⁷⁶ Carla G S Saad et al., *Immunogenicity and Safety of the 2009 Non-Adjuvanted Influenza A/H1N1 Vaccine in a Large Cohort of Autoimmune Rheumatic Diseases*, 70 ANNALS OF RHEUMATIC DISEASES 1068 (2011), filed as “Resp. Ex. A Tab 7”.

⁷⁷ Clovis A. Silva et al., *Vaccinations in Juvenile Chronic Inflammatory Diseases: An Update*, 9 NATURE REV. RHEUMATOLOGY 532 (2013), filed as “Resp. Ex. A Tab 8”.

to prove an alternative factor unrelated to vaccination was the sole cause. *Deribeaux*, 717 F.3d at 1367.

Turning next to the analysis of the experts' opinions on prong one, Dr. Maverakis agreed with Dr. Gershwin's general theory of autoimmunity but stated that the process could be triggered by sunlight. Resp. Ex. A at 9-10. Notably, he did not disagree that a flu vaccine could initiate this process, instead arguing that a strong association between flu vaccination and DM has not been established.

Dr. Gershwin agreed that epidemiology has not shown vaccinations to be a cause of DM. But in support of his opinion, Dr. Gershwin cited to three case reports discussing several patients who developed DM after vaccination with two of them receiving the flu vaccine. *See* Pet. Ex. 21(h);⁷⁸ Pet. Ex. 21(i);⁷⁹ Pet. Ex. 21(j).⁸⁰ While cases studies do not carry the import of control studies and pale in comparison to epidemiological studies, the experts herein agreed that conducting epidemiological studies is challenging in rare diseases such as DM. Pet. Ex. 18 at 3, 4-5, 7; Pet. Ex. 22 at 2-3; Resp. Ex. C at 1. Dr. Maverakis even conceded that if such an association exists between flu vaccination and DM, "it would be difficult to identify the association for reasons outlined by Dr. Gershwin." Resp. Ex. C at 1. Further, case reports are not entirely devoid of evidentiary value, particularly when discussing rare diseases and unusual occurrences, such as DM and vaccine injuries. *Patton v. Sec'y of Health & Human Servs.*, 157 Fed. Cl. 159, 166-67 (2021); *Paluck ex rel. Paluck v. Sec'y of Health & Human Servs.*, 104 Fed. Cl. 457, 475 (2012), *aff'd*, 786 F.3d 1373 (Fed. Cir. 2015).

Dr. Maverakis relied on *Mamyrova* to support his opinion that the flu vaccine is not associated with DM. It is worth noting that while *Mamyrova* did not find a statistically significant association between flu vaccines and DM flares, their data showed that 46% of the study participants did indeed have a flare following flu vaccine. Resp. Ex. A Tab 6 at 4.⁸¹

Contrary to Dr. Maverakis' contention, recent studies provide support for Dr. Gershwin's theory involving IFNs in the pathogenesis of DM. *Hornung & Wenzel* called the activation of the innate immune system with high expression of IFNs and IFN-regulated proteins a "pathological hallmark of DM." Pet. Ex. 20(a) at 1.⁸² Further, *Nagaraju & Institutet* noted that type 1 IFN has been thought to play a role in autoimmune diseases due to "its ability to break tolerance", which has been demonstrated in case reports where there was myositis onset during interferon treatment. Pet. Ex. 20(c) at 6.⁸³ *Vleugels & Callen* also noted that "the level of type I interferons has been shown to be correlated with disease activity." Pet. Ex. 23(g) at 11.⁸⁴ Dr. Maverakis conceded that type 1 IFNs "likely play a role in the disease", though he did not believe IFNs to be a strong driver of the pathophysiology. Resp. Ex. A at 9. Therefore, Dr. Gershwin's theory that interferon activation as part of the immune response to vaccination that ultimately leads to DM has support in the medical literature.

⁷⁸ Altman et al., *supra* note 30.

⁷⁹ Ferri et al., *supra* note 68.

⁸⁰ Jani et al., *supra* note 69.

⁸¹ Mamyrova et al., *supra* note 11.

⁸² Hornung & Wenzel, *supra* note 4.

⁸³ Nagaraju & Lundberg, *supra* note 18.

⁸⁴ Vleugels & Callen, *supra* note 41.

Further, based on the literature filed, there is agreement that infection can trigger the autoimmune process that leads to DM. Pet. Ex. 21(e) at 3-4;⁸⁵ Pet. Ex. 23(g) at 11.⁸⁶ Dr. Gershwin likened the immune response to an infection to that elicited by a vaccination. Pet. Ex. 18 at 5. The literature he filed supported this contention. See Pet. Ex. 21(h) at 3 (stating that infection can trigger various biologic mechanisms that induce autoimmunity and that “[t]hese mechanisms may also be operative in the case of vaccination, where an antigen . . . may trigger autoimmune responses”);⁸⁷ Pet. Ex. 21(k) at 6 (“Vaccines, like infections, activate immune mediated mechanisms to induce a protective effect.”).⁸⁸ To that end, cases of dermatomyositis have been reported following both influenza virus and influenza vaccine as well as other vaccines, lending additional support for Dr. Gershwin’s theory that immune responses to foreign antigens—either from infection or vaccination—could lead to the development of dermatomyositis. See, e.g., Pet. Ex. 21(h);⁸⁹ Pet. Ex. 21(i);⁹⁰ Pet. Ex. 21(j);⁹¹ Pet. Ex. 20(k);⁹² Pet. Ex. 21(l);⁹³ Pet. Ex. 21(m).⁹⁴

In rendering his opinion, Dr. Maverakis submitted that “the relative risk must be greater than 2, which is an extremely high association”, in order to establish a “more likely than not” association between the flu vaccination and DM. Resp. Ex. C at 2. While I appreciate Dr. Maverakis’ opinion in this case, this framing elevates petitioner’s burden beyond what is required by the Act. It seems Dr. Maverakis would like to see a certain link between a vaccination and injury before agreeing that a causal connection exists. However, as he conceded, autoimmune diseases like DM are rare and difficult to study. Further complicating potential research into this topic is that adverse reactions to vaccines are extremely rare. Typically, vaccines activate the immune system which in turn produces antibodies and results in the desired effect; but sometimes, where there is genetic susceptibility to a particular disorder/condition, the immune process may go awry and result in autoimmunity.

Dr. Gershwin provided a sound and reliable theory that environmental triggers activate the immune system of a genetically predisposed person, which involves both the hyperactivation of the innate immune system, specifically in producing type 1 IFNs which in turn produce B cell autoantibodies, and dysregulation of the adaptive immune system to begin a feedforward loop of sustained inflammation. Pet. Ex. 18 at 3, 7; Pet. Ex. 20(a);⁹⁵ Pet. Ex. 20(h);⁹⁶ Pet. Ex. 21(e);⁹⁷

⁸⁵ Wahren-Herlenius & Dörner, *supra* note 29.

⁸⁶ Vleugels & Callen, *supra* note 41.

⁸⁷ Altman et al., *supra* note 30.

⁸⁸ Hedi Orbach et al., *Vaccines and Autoimmune Diseases of the Adult*, 9 DISCOVERY MEDICINE 90 (2010), filed as “Pet. Ex. 21(k)”.

⁸⁹ Altman et al., *supra* note 30.

⁹⁰ Ferri et al., *supra* note 68.

⁹¹ Jani et al., *supra* note 69.

⁹² Timothy B. Niewold et al., *Elevated Serum Interferon Alpha Activity in Juvenile Dermatomyositis: Associations with Disease Activity at Diagnosis and After 36 Months of Therapy*, 60 ARTHRITIS & RHEUMATOLOGY 1815 (2009), filed as “Pet. Ex. 20(k)”.

⁹³ Perdan-Pirkmajer et al., *supra* note 52.

⁹⁴ Natasa Toplak and Tadej Avcin, *Influenza and Autoimmunity*, 1173 ANNALS N.Y. ACAD. SCI. 619 (2009), filed as “Pet. Ex. 21(m)”.

⁹⁵ Hornung & Wenzel, *supra* note 4.

⁹⁶ Wenzel et al., *supra* note 37.

Pet. Ex. 21(n) at 3-5;⁹⁸ Pet. Ex. 30 at 8.⁹⁹ The literature he provided supports that infection or vaccination may initiate this process. Pet. Ex. 21(e) at 3-4;¹⁰⁰ Pet. Ex. 23(g) at 11.¹⁰¹ Dr. Maverakis' opinion largely focused on other potential cause(s) of DM without effectively rebutting Dr. Gershwin's theory on causation. *See Ulysse v. Sec'y of Health & Human Servs.*, No. 15-451V, 2022 WL 2115248, at *20 (Fed. Cl. Spec. Mstr. May 19, 2022) (finding in favor of a petitioner in a flu / DM case but noting that "[i]n a different case, with a more substantive opposition marshaled by Respondent, the outcome would likely have been different."); *see also Hunt v. Sec'y of Health & Human Servs.*, No. 20-1455V, 2024 WL 3173262, at *10 (Fed. Cl. Spec. Mstr. May 23, 2024) (finding against a petitioner in a flu / DM case where "Dr. Gershwin [] cited seven specific publications that he asserts support the plausibility of the flu vaccine as a cause of IIMs, each of which respondent's experts . . . sought to rebut.").

Based on the evidence and the opinions of the respective experts, I find that petitioner has provided a sound and reliable theory that flu vaccine can act as an environmental trigger for dermatomyositis in a genetically predisposed individual. As such, petitioner has satisfied prong one.

B. Petitioner Has Demonstrated a Logical Sequence of Cause and Effect

To satisfy prong two, petitioner must demonstrate by preponderant evidence that the vaccination did cause the injury alleged. *Hodges v. Sec'y of Health & Human Servs.*, 9 F.3d 958, 962 n.4 (Fed. Cir. 1993) (citation omitted). While petitioner need not eliminate other potential causes in order to meet her burden, "evidence of other possible sources of injury" may be relevant in determining whether the vaccine was a substantial factor in bringing about the injury. *Walther*, 485 F.3d at 1149-52; *Stone*, 676 F.3d at 1379.

The experts agreed that the correct diagnosis is DM. Pet. Ex. 18 at 1; Resp. Ex. A at 7. Petitioner argued that she was genetically predisposed, and the flu vaccine triggered the development of DM. Pet. Ex. 18 at 6. Respondent's argument against the flu vaccine being the most likely cause of petitioner's DM was two-fold: 1) he argued the onset of petitioner's DM occurred prior to her receipt of flu vaccine, and 2) he argued that sun exposure was a more likely cause of her DM. Resp. Ex. A at 8.

Dr. Gershwin submitted that the flu vaccine petitioner received on November 3, 2018 activated her innate immune system which produced interferons in response. Pet. Ex. 18 at 3-4, 7. Her unique IFN signature facilitated antigen presentation of autoantigens to plasmacytoid dendritic populations, which in turn produce more IFN. With a dysregulated adaptive immune system, this cycle continued in a loop where inflammation was sustained. *Id.*

⁹⁷ Wahren-Herlenius & Dörner, *supra* note 29.

⁹⁸ Wraith et al., *supra* note 31.

⁹⁹ Lu Gan & Frederick W. Miller, State of the Art: What We Known About Infectious Agents and Myositis, 23 *Current Opinion in Rheumatology* 585 (2011), filed as "Pet. Ex. 30".

¹⁰⁰ Wahren-Herlenius & Dörner, *supra* note 29.

¹⁰¹ Vleugels & Callen, *supra* note 41.

Further, infection is understood to be the most common environmental factor that triggers an autoimmune process, with several proposed causal mechanisms, including 1) infectious agents interacting with self-proteins, which then become novel and neo-antigens, 2) infectious agents rendering an otherwise sequestered antigen exposed and vulnerable to an immune response, 3) cross reactivity between infectious agent and self-proteins, and 4) infectious agents producing non-specific activation of otherwise low affinity autoreactive cells leading to their expansion. Pet. Ex. 18 at 5. Dr. Gershwin explained that a vaccination is “designed to fool the body into thinking it is responding to an infection”, thus any of these mechanisms may be triggered in response to a vaccine. *Id.* Here, there is no evidence of an antecedent infection in petitioner in the time leading up to the onset of her DM. *Id.* at 5. This leaves the flu vaccination as the most likely cause of petitioner’s development of DM. *Id.* at 5, 8.

Dr. Maverakis argued that Dr. Gershwin’s opinion that the flu vaccine activated petitioner’s immune system and facilitated antigen presentation of autoantigens to plasmacytoid dendritic populations was “entirely speculative”. Resp. Ex. A at 10. He submitted that petitioner’s autoantibody titers were not measured, so there was no evidence to support that she developed autoimmunity as a result of vaccination. *Id.* He then conceded that autoantibody titers are typically not performed on patients with autoimmunity. *Id.*

Dr. Maverakis also argued that petitioner complained of symptoms of DM prior to vaccination, so the vaccine could not have been the cause-in-fact of her DM. He noted that petitioner had previously reported muscle weakness which is a sign of DM. Resp. Ex. A at 8; Pet. Ex. 23(a) (explaining that DM presents with a “varying degree of muscle weakness” with the “initial presentation of muscle involvement [] typically symmetric and proximal, with distal muscle weakness occurring late in the course of the disease.”).¹⁰²

Dr. Maverakis opined that petitioner “was clearly complaining of muscle weakness, starting months prior to her receiving the vaccination” and “was clearly having some issues with muscle soreness and weakness prior to her receiving the influenza vaccination.” Resp. Ex. A at 8. He based this opinion on a questionnaire that petitioner filed out on January 19, 2018. *Id.*; Pet. Ex. 3 at 72.

Dr. Maverakis relied on a record that contains multiple questionnaires filled out by petitioner on January 19, 2018. Pet. Ex. 3 at 63-69. One was a Foot Health Questionnaire which asked, in relevant part, if she had reduced sensation in her feet, pain or cramping in her feet, calves, thighs or buttocks when walking, or numbness or tingling sensation in her feet, all to which she responded “no”. *Id.* at 70.

The questionnaire referred to by Dr. Maverakis reads as follows:

¹⁰² Marvi et al., *supra* note 42.

HEALTH QUESTIONNAIRE

Kristine Ballard 7/9/69 11/9/18
 Name Print Date of Birth Your primary doctor Today's Date

Symptom	YES / NO	Other / Notes
Do you experience any neck or back pain?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
Do you experience any joint pain? If yes, where? <input type="checkbox"/> Hip <input type="checkbox"/> Shoulder <input type="checkbox"/> Knee <input type="checkbox"/> Elbow <input type="checkbox"/> Wrist <input type="checkbox"/> Ankle	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Shooting and/or radiating pain into legs and/or arms?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Have you had a recent trauma causing back or joint pain? (Example: motor vehicle accident, trip, fall, etc.)	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
Do you experience pins and needles sensations? If yes, where? <u>feet</u>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
Do you experience numbness and/or weakness? If yes, where? <u> </u>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Do you experience burning sensations in legs or arms? If yes, where? <u> </u>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Do you experience pain from things that aren't usually painful? (Example: light touch, temperature, joint movement)	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Do you experience motor symptoms? (Example: weakness, tremors, spasms etc.)	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Do you experience temperature asymmetry? (Example: left hand/leg/foot feels colder than the right)	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Have you noticed any skin color changes in different sides of the body? (Example: left hand/leg/foot looks a different color than the right side)	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Do you have a history of back surgery or failed back syndrome?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Do you have a history of back surgery or failed knee surgery?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	

Pet. Ex. 3 at 72. The page is confusing at first glance because the box to check "No" is under the word "Yes", while the box for "Yes" is to the right of the word "Yes". Thus, it appears Dr. Maverakis misinterpreted this record when he determined that petitioner answered "Yes" to experiencing various symptoms, most importantly numbness or weakness, motor symptoms, and radiating pain into legs/arms. Resp. Ex. A at 3, 8. The record shows that petitioner checked "No" to these various symptoms. Pet. Ex. 3 at 72. She checked "Yes" only for neck or back pain, recent trauma causing back or joint pain, and pins and needles in her feet. *Id.*

As Dr. Gershwin correctly pointed out, none of petitioner's medical records at any visit leading up to the subject vaccination documented muscle complaints. Pet. Ex. 22 at 1; Pet. Ex. 3 at 16-18, 23-24, 77 (complaining of breathing issues and IBS on January 19, 2018; restless leg syndrome on January 22, 2018; headaches, congestion, coughing, and shortness of breath on February 7, 2018; flu, exacerbation of asthma, and breast pain from coughing in March 2018). In

fact, petitioner did not report muscle weakness/involvement until May 7, 2019—over six months after receiving the subject vaccine. Pet. Ex. 8 at 3-4. Thus, there is no evidence in this case that petitioner had any symptoms of dermatomyositis prior to her receipt of the subject flu vaccine.

Dr. Maverakis also argued “there is overwhelming evidence that sunlight can trigger dermatomyositis” which is “clearly what happened in [petitioner’s] case.” Resp. Ex. A at 8; Resp. Ex. C at 2. He explained that photo-distributed rashes present on the “V portion” of the neck, outside of the arms, and on the back of hands. Resp. Ex. A at 8. He then referenced photos filed into evidence and visit notes from March 7, 2019, which documented “photodermatitis” on petitioner’s arms, chest, and face, and stated that petitioner’s rash was photo-distributed and thus triggered by sunlight. *Id.*; Resp. Ex. C at 2; *see also* Pet. Ex. 4 at 5-8. He claimed that photo-distributed rashes can only be caused by light. Resp. Ex. A at 8.

Dr. Gershwin agreed that petitioner’s rash was most dominant on sun-exposed sites, but he disagreed with Dr. Maverakis’ conclusion that this indicated sunlight was the trigger. Rather, Dr. Gershwin stated that DM rashes are typically on photosensitive sites. Further, there is no evidence that petitioner’s sun exposure changed prior to the onset of her DM. Pet. Ex. 22 at 3.

The literature shows the rash associated with DM typically appears on sun exposed areas regardless of the cause. DM typically presents with skin manifestations like heliotrope rash, Gottron’s papules, the V-sign, and shawl sign. Pet. Ex. 23(a) at 1;¹⁰³ Pet. Ex. 23(f).¹⁰⁴ *Vleugels & Callen* stated that the “cutaneous disease in [DM] is photodistributed and often photoaggravated.” Pet. Ex. 23(g) at 12.¹⁰⁵ Similarly, *Dourmishev* stated that the “[c]utaneous features of [DM] strongly suggest that ultraviolet (UV) radiation plays an important role in the pathogenesis of the disease.” Pet. Ex. 23(h) at 1.¹⁰⁶ In an article distinguishing DM from polymyositis, *Dalakas* stated that a DM “rash can be exacerbated after exposure to the sun”. Pet. Ex. 20(p) at 2.¹⁰⁷ Further, *Mamyrova* noted that ultraviolet radiation has been associated with the initiation of DM and found that it was one of “the most significant environmental risk factors associated with flare in DM.” Resp. Ex. A Tab 6 at 1.¹⁰⁸ *Dourmishev* argued that photosensitivity is a “frequent sign in DM patients and ought to be one of the major criteria for DM diagnosis.” Pet. Ex. 23(h) at 4.¹⁰⁹

Based on the forgoing, it is entirely possible—if not likely—that petitioner’s rash was worsened by sunlight and was thus more pronounced in areas exposed to the sun regardless of what caused her DM. The locations of the rash alone do not preponderantly show that sunlight was the cause of her DM or that the vaccination was not the cause.

Further, Dr. Gershwin is correct that her sun exposure did not change in the time leading up to the vaccination prior to the onset of her DM. Petitioner lived in Arizona since at least early

¹⁰³ Marvi et al., *supra* note 42.

¹⁰⁴ Cheong et al., *supra* note 43.

¹⁰⁵ Vleugels & Callen, *supra* note 41.

¹⁰⁶ Dourmishev et al., *supra* note 45.

¹⁰⁷ Marinos C Dalakas & Reinhard Hohlfeld, *Polymyositis and Dermatomyositis*, 362 LANCET 971 (2003), filed as “Pet. Ex. 20(p)”.

¹⁰⁸ Mamyrova et al., *supra* note 11.

¹⁰⁹ Dourmishev et al., *supra* note 45.

2014, according to one medical record that went back to February 2014. *See* Pet. Ex. 3 at 55. Petitioner lived in Arizona at the time she received the subject flu vaccination. Pet. Ex. 2 at 1. There is no evidence to suggest that there was a change in her sun exposure in the months prior to the onset of her DM, and respondent did not point to any such evidence. In fact, petitioner reported to one provider that her last vacation was to Mexico in July 2018—close to five months prior to the onset of her skin rash. Pet. Ex. 4 at 22. Respondent did not explain how increased sun exposure from 5 months prior could cause the onset of DM. If his argument instead was that continued sun exposure over petitioner’s lifetime (and not necessarily an increase in exposure) was responsible, he failed to explain why the disease began when it did and not at any point in petitioner’s prior 49 years of life.

Based on the evidence filed, sun exposure (or UV radiation) is capable of both initiating the disease process involved in DM and worsening DM symptoms regardless of what caused it. This makes sense, given petitioner’s physicians warning her to stay out of the sun once diagnosed with DM and her own reports that sun-exposure worsened her DM symptoms. *See, e.g.*, Pet. Ex. 4 at 5, 8; Pet. Ex. 14 at 3. To be clear, petitioner’s treating providers recommended that she avoid sun exposure after she was diagnosed with DM; at no point in the medical records did her providers opine that her DM was caused by the sun.

Thus, there is persuasive evidence that sunlight could play a role in causing DM. However, the fact that sun exposure could play a role in DM generally does not refute the vaccination as a substantial factor in petitioner’s development of DM. As explained by *Gan & Miller*, “it is possible that multiple environmental agents, either together or in a sequence, may be needed to induce autoimmune responses”. Pet. Ex. 30 at 7.¹¹⁰ Further, there is more evidence in the record to support the vaccine as the cause rather than sunlight. As will be discussed more thoroughly under prong three, the evidence shows that petitioner’s symptoms began two weeks after vaccination which is consistent with the causal mechanisms proposed by petitioner. Though temporal association alone is not sufficient to prove causation, the timing of petitioner’s symptoms in combination with a persuasive theory of causation preponderates to show that the flu vaccine was the most likely cause of petitioner’s DM.

In summary, Dr. Gershwin persuasively explained that petitioner had a genetic predisposition and/or “unique” interferon signature within her innate immune system that, when exposed to the flu vaccine, activated certain cellular pathways that contained disease-associated polymorphisms and ultimately resulted in DM. Pet. Ex. 18 at 3, 5, 7. Dr. Maverakis agreed that the signaling and effector pathways of genetic polymorphisms can lower signal thresholds and create a loop that sustains inflammation. Resp. Ex. A at 9-10. His only counterarguments to Dr. Gershwin’s opinion were that sunlight triggered this process in petitioner—not the flu vaccine—and that her onset of DM preceded the subject vaccination. *Id.* For the reasons set forth above, these counterarguments were not persuasive. Accordingly, I find that petitioner provided preponderant evidence to support *Althen* prong two.

¹¹⁰ *Gan & Miller, supra* note 99.

C. Petitioner Has Demonstrated a Proximate Temporal Relationship

To satisfy prong three, petitioner must demonstrate by preponderant evidence that the onset of symptoms related to her injury occurred within a medically reasonable timeframe to infer causation. *de Bazan*, 539 F.3d at 1352.

Dr. Gershwin concluded that petitioner's onset of symptoms 2-3 weeks after vaccination was medically reasonable. He discussed the development of DM through experimental mouse models which involved genetically susceptible mice immunized with a muscle autoantigen found in myositis. Within 14 days post-immunization, the mice had autoantibodies. Pet. Ex. 18 at 6; Pet. Ex. 21(c).¹¹¹ Based on the foregoing, Dr. Gershwin opined that an onset of 2-3 weeks is consistent with the causal mechanisms he provided and is consistent with petitioner's onset. Pet. Ex. 18 at 8.

Dr. Maverakis disagreed that this mouse model could be extrapolated to humans to show that flu vaccine can cause DM because the mice were immunized with a self-antigen. However, he agreed "that the purely temporal relationship between the [p]etitioner's rash and the vaccination is reasonable". Resp. Ex. A at 9.

With the experts agreeing that 2-3 weeks is a medically appropriate timeframe for onset, I find that onset 2-3 weeks post-vaccination is medically reasonable.

Though petitioner's reporting to medical providers regarding the onset of her rash varied between the end of November and the end of December 2018, the contemporaneous medical records indicate that petitioner's first symptom of DM was a rash that was documented on November 18, 2018. Pet. Ex. 11 at 4 (visit notes documenting that petitioner had a "rash on arm, thinks it may be eczema? Suggested she see Dermatologist"); *see also* Pet. Ex. 3 at 13; Pet. Ex. 4 at 22-23; Pet. Ex. 6 at 11; Pet. Ex. 8 at 3; Pet. Ex. 14 at 3; Pet. Ex. 15 at 7. Accordingly, the onset of petitioner's DM was around November 18, 2018—approximately two weeks after the flu vaccination.

With preponderant evidence supporting the onset of petitioner's DM on or around November 18, 2018, and with both experts opining that 2-3 weeks is a reasonable timeframe for onset, petitioner has satisfied prong three.

D. Respondent's Burden to Show Unrelated Factors

Because petitioner has established a *prima facie* case of causation under *Althen*, she is entitled to compensation unless respondent can show by a preponderance of the evidence that her injury was in fact caused by a factor unrelated to the vaccine. *Deribeaux*, 717 F.3d at 1367; *see* § 13(a)(1)(B). To meet this standard, respondent must "present sufficient evidence to prove that the alternative factor was the sole substantial factor in bringing about the injury." *Deribeaux*, 717 F.3d at 1367. The Vaccine Act limits the scope of unrelated factors by excluding any "idiopathic, unexplained, unknown, hypothetical or undocumentable cause, factor, injury, illness or condition." § 13(a)(2)(A). "In other words, alternative causes that are 'idiopathic, unexplained,

¹¹¹ Katsumata et al., *supra* note 32.

unknown, hypothetical or undocumentable’ cannot overcome a petitioner’s prima facie case.” *Doe*, 601 F.3d at 1357 (quoting § 13(a)(2)(A)).

Summarily, respondent argued that sun exposure is a known trigger of DM and thus, sunlight triggered the onset of petitioner’s DM and not the flu vaccine. Resp. Ex. A at 8; Resp. Ex. C at 2. As support, Dr. Maverakis referenced photos filed into evidence and visit notes from March 7, 2019, which documented “photodermatitis” on petitioner’s arms, chest, and face, and stated that petitioner’s rash was photo-distributed and thus triggered by sunlight. *Id.*; see also Pet. Ex. 4 at 5-8.

As discussed under prong two, while sunlight is a known trigger for DM, it is not the only trigger based on the literature filed herein. To suggest sunlight as the cause without more is insufficient to satisfy respondent’s burden in proving an alternative factor unrelated to the vaccine as the sole cause of petitioner’s DM. *Deribeaux*, 717 F.3d at 1367. The only evidence Dr. Maverakis cited to support his opinion that sunlight was a more likely cause of petitioner’s DM was the fact that her rashes were photo distributed. Resp. Ex. A at 8. The literature shows that DM patients are photosensitive. Pet. Ex. 23(g) at 12;¹¹² Pet. Ex. 20(p) at 2;¹¹³ Pet. Ex. 23(h) at 4.¹¹⁴ Thus, the locations of petitioner’s rash alone do not preponderantly show that sunlight was the cause-in-fact of her DM. Further, Dr. Maverakis did not provide any opinion related to a timeframe within which to expect sunlight to cause DM nor did he specify whether it was his opinion that continued exposure over petitioner’s lifetime was responsible versus a sudden increase in sun exposure. In short, Dr. Maverakis made a rather conclusory statement that sunlight was the most likely cause of *this* petitioner’s DM because sunlight is a known cause of the condition generally and because petitioner’s rashes were on sun-exposed sites. Without more, this argument does not overcome petitioner’s prima facie case that the flu vaccine caused her DM.

Therefore, respondent failed to show by preponderant evidence that an alternative cause—namely sunlight—was the sole substantial factor in causing petitioner’s DM.

VIII. Conclusion

Upon careful evaluation of all the evidence submitted, I conclude that petitioner has provided preponderant evidence that the influenza vaccine she received on November 3, 2018 triggered her dermatomyositis. Respondent failed to overcome petitioner’s prima facie case in proving by preponderant evidence that an alternative factor was the sole substantial factor that caused her DM. Accordingly, petitioner is entitled to compensation under the Vaccine Act, and this case shall proceed to damages.

IT IS SO ORDERED.

s/ Mindy Michaels Roth
Mindy Michaels Roth

¹¹² Vleugels & Callen, *supra* note 41.

¹¹³ Dalakas & Hohlfeld, *supra* note 107.

¹¹⁴ Dourmishev et al., *supra* note 45.

Special Master